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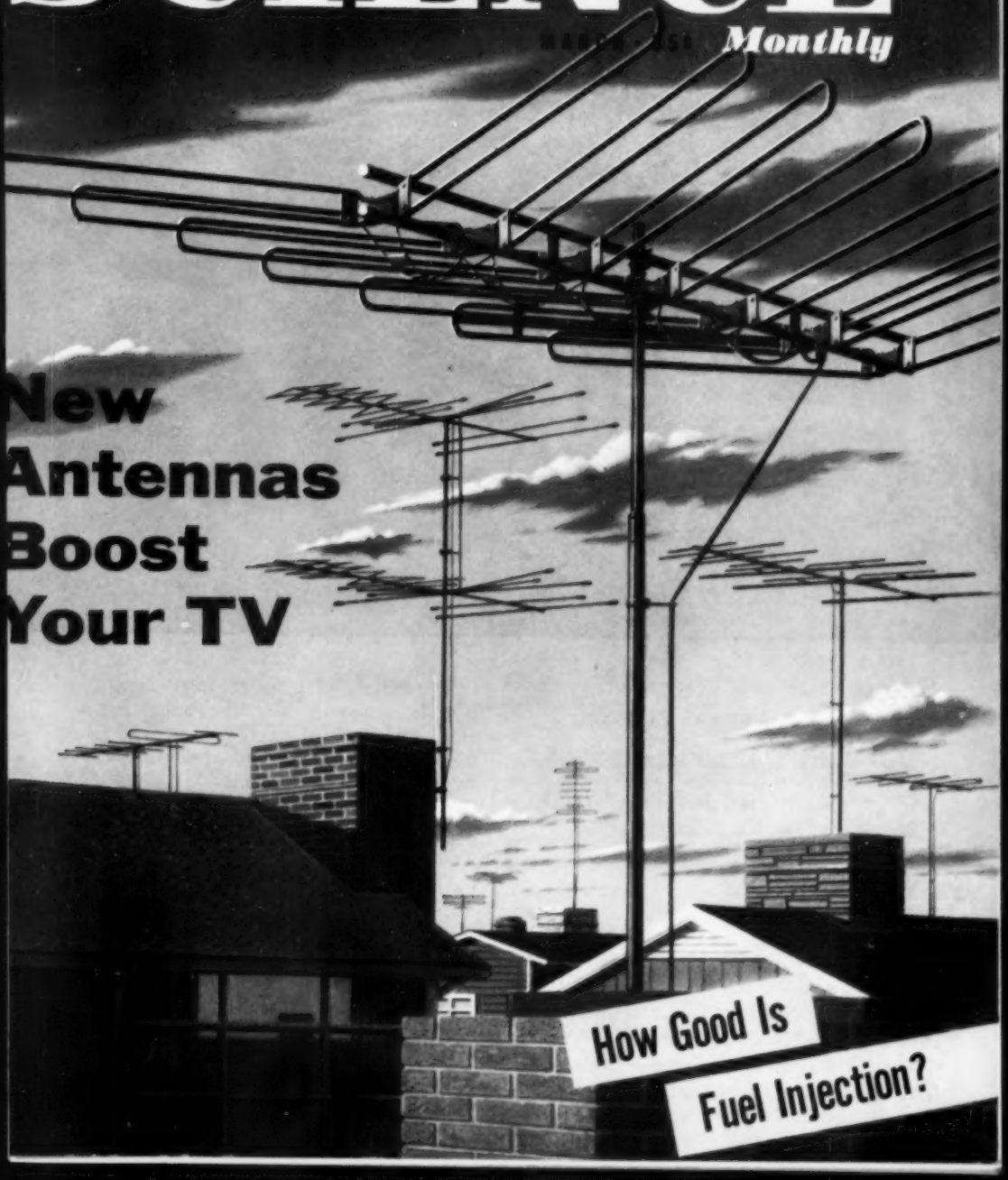

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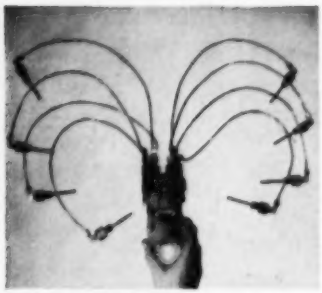
Popular Science Monthly

March, 1957



An FI unit like this may be under the hood of your next car. Does it work well? Here's the latest word on what may be the hottest auto news of '58

Just-released photos of the Air Force's first supersonic bomber, the B-58 Hustler. Fast? It can blow jet exhaust at an F-100

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This youngster could be in for trouble. His problem: He's smarter than the other kids. Here's straight talk on how to bring up a child with a high IQ

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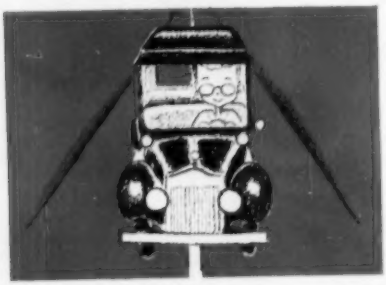
PS Readers

TALK BACK

Other "Worst Drivers" Are Nominated

In my opinion, "Who Are America's Worst Drivers?" [Jan.] was one of your best articles, as far as it went. But it tended to be very one-sided, and gave the impression that without the 15-to-25-year driver group our highways would be accident-free.

How about a follow-up story on the older folks driving who shouldn't have a driver's license? I mean the innocent little old ladies



who poke along a public highway at 20 miles an hour. Also, what about the older men in their new Chrysler 300s who have got to be the first away from every stop light?

Walter Speekmann, University City, Mo.

. . . I have just finished reading your article. As vice-president of the Montereys Road Club of Miami, I do not like to see my age group being marked as unsafe drivers. We would like to start a Road-E-O to teach people that you may be a fast driver but not a good driver.

John F. Porter, Miami, Fla.

. . . A year ago the Careful Drivers Club, with the co-sponsorship of the Colorado Safety Council, conducted a Safe Driving Contest for Denver high-school students. A college tuition award was the prize.

There were two phases to the contest. First, those students who received traffic tickets during the period of the contest were eliminated. Second, every time a student received a ticket, that ticket was charged against the student's school. The two schools with the best records received safe-driving trophies.

Since a ticket would eliminate the participant and also would count against his school, it became unpopular to drive carelessly.

In our first contest, 545 students participated from Denver. This year [1956] we opened the contest to all high-school students in the state. We would like to extend this contest to every high school in the United States.

James W. Phelps,
Careful Drivers Club, Inc., Denver.

Our Global Bomber *Can* Stretch Range

The Boeing B-52 Frank Harvey writes about [Jan.] undoubtedly poses a terrific deterrent to global war.

There is only one drawback. . . . It does not have enough range to strike at the heart of Eurasia and return to this continent without aerial refueling. Does PS have any information on how many aerial-refueling aircraft are in operation—or how far the B-52 can fly without them?

Robert F. Dorr, Washington, D. C.

The exact number of aerial tankers is secret. The Strategic Air Command says, however, that somewhere in the world, throughout the year, one of their planes is being refueled in the air every 3½ minutes. Range of the B-52 is given as "over 6,000 miles."

Coffee Rides the Rails Smoothly

The Santa Fe's new "hi-level" El Capitan [Jan.] is everything Mr. Griswold said, and more. . . . In the diner I received a *full* cup of coffee instead of the usual three-quarters of a cup, because there was no sway or jolting to spill it.

A. J. Reichert, La Crosse, Wis.

Volkswagen Hits 78 M.P.H.

In your January issue [PS Readers Talk Back] you say most VWs go 67 to 68 m.p.h. I have a stock 1956 VW that flattens out at 78 m.p.h. and stays there until you back off

Is your engine tired out, too?

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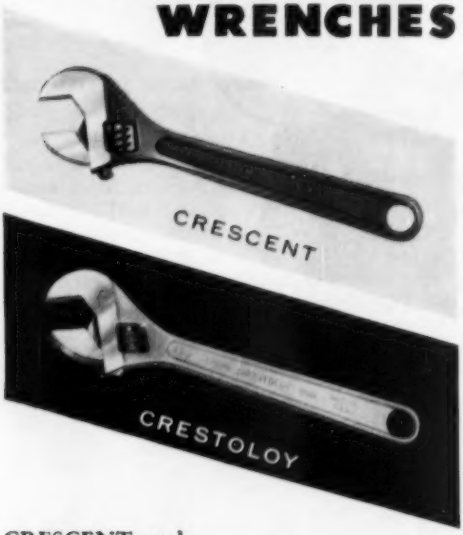

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the throttle. I have done this many times on a flat road and with *no* tail wind.

ALTON OVERHOLT, Whittier, Calif.

Sounds like an unusually cheerful speedometer.

He'd Like to See *Us* Make . . .

"I'D LIKE to see *you* make" an illustration showing a folded newspaper on the floor with a tin can on it and a foot pressing down on the can. That beats the tin-can press in your December issue.

JOSEPH S. CHEMEL, Tulsa, Okla.

No sooner said than drawn.

Give the Brake a Break, Says He

IN YOUR January issue reader B. E. Williams suggests a hydraulic shock absorber on the back of semitrailers to apply the carrier's brakes upon backing to a loading dock. I would like to suggest an improvement by arranging the setup to operate *only* while backing. . . . I'd hate to think of the pile-up should the trailer be accidentally bumped from behind while on the expressway doing 60 miles an hour. Will reader Williams be available to scrape the following cars and drivers off the back of said trailer?

CHARLES WELLS JR., Dallas

Recorder Manufacturers Take Note

WHAT in the world is keeping back transistor tape recorders? With transistor radios available, isn't it high time tape recorders also came out with transistors instead of tubes?

ANDREW VENA, Philadelphia

How About It, Hi-Fi Fans?

MANY thanks for your very interesting articles on Hi-Fi. How about some articles on tape recorders and tape decks?

ROBERT W. FORD, York, Pa.

Anticipating TV Trouble

IN THE December issue one of your readers suggests that a blank TV may be cured by switching duplicate tubes.

Here's another suggestion. A good investment for a TV owner is a set of new replacement tubes, one of each type in use. Then he can try these one at a time until he has found the trouble (if it's a defective tube),

YOUR MOVE, DAD!

The first frantic months of fatherhood are over. You have time now to really enjoy the new baby—and time to really think ahead.

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discard the bad one and get a new tube for his stock of spares.

MAX COBEN, Little Silver, N. J.

Dead Sea Scrolls Make Timely Topic

I READ with great interest your wonderful report on the Dead Sea Scrolls in the December issue. It came at a time when our Bible class was discussing hidden treasures.

MERLE E. BAUGHMAN, Kansas City, Mo.

There Are Easier Ways to Economize

IN THESE days of rising prices, many of us are having to do with old things. How about an article on resharpening old files?

R. W. SNYDER, Washington, D. C.

Soaking worn files in nitric or muriatic acid for about 10 minutes and then washing with soap and water will rehabilitate them for rough work. Considering the cost of the acid, however, the saving is doubtful.

Leaking Faucet Stays Fixed

YOUR article on faucets [Jan.] reminds me of an incident of several years ago. I had been using the best washers but they would last only three or four months. So I thought I would experiment with a notion I had.

I found a piece of sheet lead 3/32" thick. With a sharp knife I cut out two circles that would fit the cup where the washer goes. Holes were drilled for the screw. The lead washers were dropped in the cup and the

screw set snug. The faucet was assembled and the handle turned down hard three or four times to get a seat. The payoff: That job lasted four years and three months.

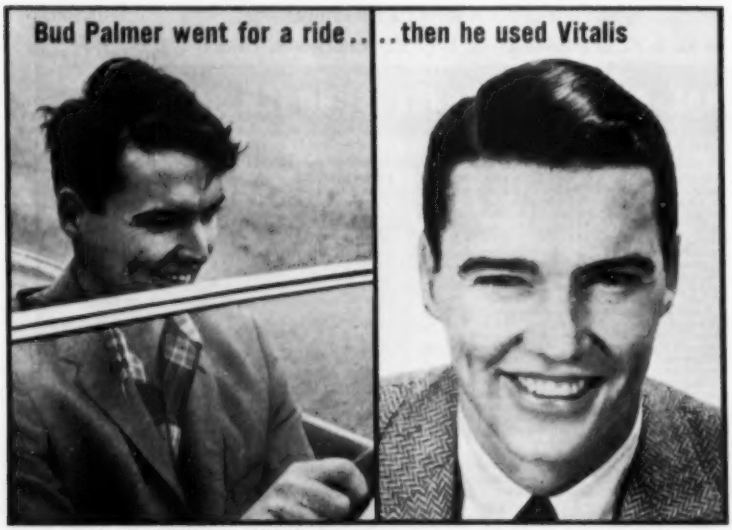
H. Y. BALLOU, Manhattan Beach, Calif.

He's a Meter Reader Now

YOUR article, "How Your Electric Meter Works" [Dec.], was an eye-opener. For the first time, I can read my own meter.

J. BEVIN, W. Hempstead, N. Y.

New greaseless way to keep your hair neat all day



Sports car fan Bud Palmer is a Vitalis fan, too.

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You know that the "breaks" go to the man or woman who is *prepared* to take advantage of them—to the person who can fill the better job and who is worth more money. He makes the "breaks" instead of waiting for them.

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Please send me, free of all cost or obligation, your illustrated book, "Accountancy, The Profession That Pays."

Name..... *Age*.....

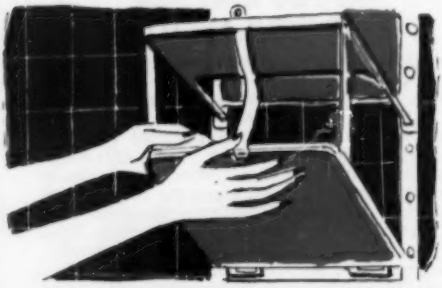
Address.....

City, Zone, State.....

"I'd like to see them make..."

A HOSE SUPPORT with an adjustable clamp to fit the rim of any tub, trough or bucket so that you wouldn't have to stand by to fill it. —*Joseph Castilla Jr., McAllen, Tex.*

STEERING WHEELS that wouldn't obscure the car's dashboard instruments. A disk of clear plastic with finger grips at the sides would do the trick.—*Carol Faille, Hoboken, N. J.*



A FOLD-AWAY HIGH CHAIR for small kitchens. It could be attached to a wall or the top of a base cabinet and dropped down at baby's meal time.—*N. M. Moore, East Orange, N. J.*

INTERCHANGEABLE CLEATS for sports shoes. Then a young athlete going out for both football and baseball wouldn't have to shell out so much. —*William B. Braden, Memphis, Mich.*

DANGER-SIGNALING ELECTRICAL WIRING. An odor would warn you of overloads before the wire got hot enough to burn off insulation and start a fire.—*A. R. Dunham, Pasadena, Calif.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

Train at Home in Spare Time for Good Jobs – Better Pay

Today, choose the career you want and take the first step toward that goal. Training plus opportunity is the perfect combination for success. NRI has trained thousands of men at home, in their spare time. NRI is the oldest, largest home study Radio-TV school . . . our 40 years' experience in training men can be your doorway to success.

Be a Radio-TV Technician

Radio-Television is America's fast growing industry. That's why it has special appeal to ambitious men not satisfied with their job and earnings. 4,000 Radio and TV stations on the air. 150 million home radios, 40 million TV sets. Plan now to get into Radio-TV. NRI can supply training quickly. Keep your job while learning. Soon after enrolling many students start to earn $10, $15 a week extra in spare time fixing sets for neighbors, pay for their course this way. Multi-tester you build helps make spare time earning.

Fix Electrical Appliances

Electric Appliance Repair offers you good pay, SECURITY. Every wired home averages 8 electrical appliances. Up to 10 million more sold every year. Owners pay well to keep them in repair. Train now to earn more in a good job or step up your income with a business of your own. As an Appliance Service Technician your opportunities are broad —your services wanted, highly regarded in your community.

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NRI training is learn-by-doing. You get easy to understand lessons. NRI sends you kits of parts to build equipment for practical experience. Find out now what NRI Radio-TV Servicing or Communications training offers you. Check and mail the coupon below.

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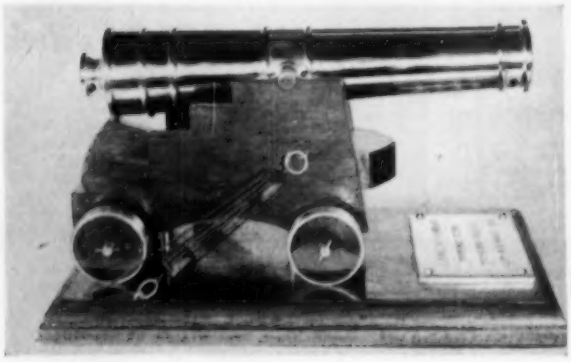
City_____ Zone_____ State_____

ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

Prize Projects BY PS READERS

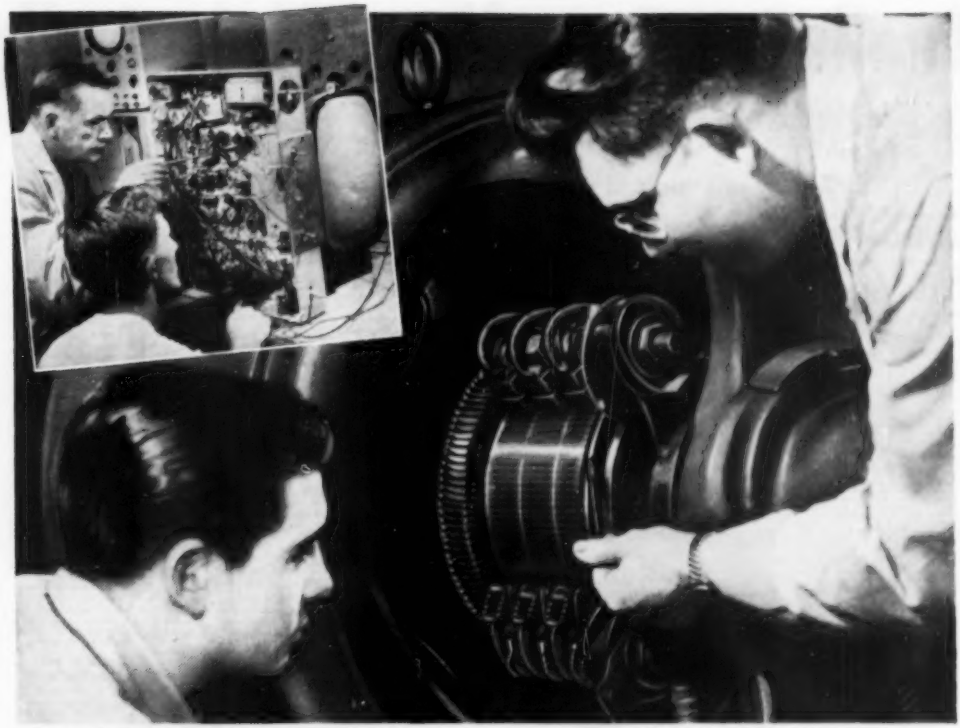
Baby Hot Rod. John H. Weber's sons roar around their Anchor, Ill., back-yard track at 40 m.p.h. in this midget. It packs a five-hp. engine out back, and its body was once a Willys hood. For protection from possible crashes, there are a roll bar and safety belt.

Motor Sled. Parts for this 50-m.p.h. ice skimmer cost Joe Zagony of Cleveland about $75. To propel it, he uses an air-cooled power-saw motor fitted with a Mercury automatic clutch. A four-pulley system hooks the engine to a drive wheel at the rear—a bike sprocket wheel with cleats welded to the sprockets. A coil spring keeps it down on the icy roadbed. A steering wheel holds the 8′-long two-seater on its course and a hand brake brings it to a quick stop.



Tiny Cannon. This model of a cannon served by seamen when the U. S. Navy was in its infancy was built by Lt. Daniel H. Flensborg of the Watertown (Mass.) Arsenal. The 10½″ bronze barrel has a ⅜″ bore and touchhole that allow the piece to be fired. Carriage and base are made of mahogany, the axles and wheel rims of brass.

Have you recently completed a workshop project of which you are particularly proud? Send a good photograph of your work, along with the negative and a brief description, to POPULAR SCIENCE MONTHLY's Mechanics and Handicraft Editor, 353 Fourth Ave., New York 10, N. Y. We will pay $15 for each item that is accepted for publication.



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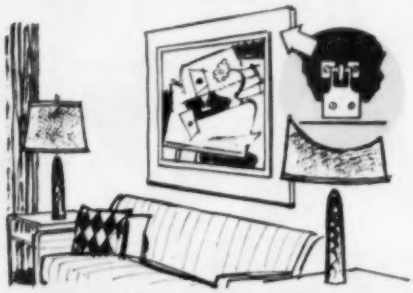
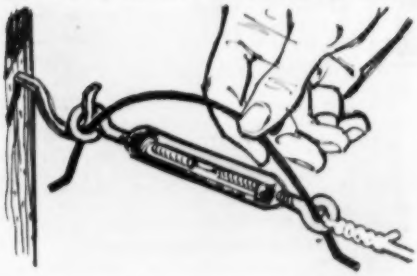
Keeping the Home Shipshape

HANG UP PAINTBRUSHES to protect the bristles. Drill holes in the handles and string them on a wire hanger that has been cut at one end and bent to form an easily opened hook.



HANGING A HEAVY PICTURE OR MIRROR? Use sash hangers and it won't hang unevenly. Screw the hook end to the wall and fasten the hanger's eye part to the back of the frame.

WHEN INSTALLING DOUBLE-HUNG FLUSH DOORS on cabinets, here's one way to be sure they'll meet in a perfect fit: Cut a single piece of plywood to fill the whole opening, allowing 1/16" for clearance. Draw a guide line down the center of the piece and cut two saw kerfs a third of the way in at top and bottom. Then hang the plywood and saw the doors apart.



LOCK A CLOTHESLINE TURNBUCKLE so it won't become unscrewed when a high wind begins twisting clothes around the line. A stiff wire passed through the eyebolts will secure it.

IF PAINT WON'T STICK when you're redecorating kitchen canisters, bread boxes or waste baskets, try applying a thinned coat of pure white shellac to the cleaned metal surface first.

Up to 9 Miles More Per Gallon! Up to 20 More Horsepower!

All From One Simple Change in Your Car!

YES! In the next two minutes I'm going to show you how you can get up to 20 MORE HORSEPOWER from your car . . . how you can save enough gas in a single year to drive up to A FULL THOUSAND MILES . . . how you can eliminate most of the ignition knocks and pings that are driving you crazy now . . . how you can get battery-saving, sure-fire starting even in below-freezing weather—and do it without buying one single complicated gadget—without paying a mechanic a penny! How? SIMPLY BY CHANGING THE COLOR OF YOUR SPARK PLUGS!

By ED MITCHELL

Let me say this at the start. What I'm offering you on this page is a very simple investment. I want you to try the most fantastic spark plug in the world, entirely at my risk! A spark plug that costs *only a few pennies* more than the old-fashioned model that's on your car today. A spark plug that lasts up to 10 *times as long* as that old-fashioned model . . . that gives you the *full blazing horsepower* that that old plug is robbing you of today . . . and that actually saves you enough gas *to drive half way across America*, every single year that you use it!

Does this sound impossible? *It's been proven a thousand times this year!* Here is a small sample of that proof.

This Is Why Your Car WastesGas,LosesPower

Some day, if you ever have a spare moment, *lift one of the spark plugs out of your car!* Look at the bottom of that plug. In 10 seconds, you'll learn more about gas waste than any book could teach you in a year.

If that plug has been in your car a thousand miles or more, then what you'll see on the bottom of that plug is *FILTH!* The Firing Point of that plug — the most important single point in your car—*still be choked to death with BLACK, FILTHY CARBON! Carbon that robs your car of as much as 20 vital horsepower every time your engine fires!*

Now, wipe that filth away. And look at the Firing Point itself. This is the *POWER POINT* of your car . . . the pin-head of electricity that turns raw gas into 200 horsepower of driving energy! And what is the condition of that Point? *CORRODED . . . PITTED . . . SCARRED . . . AND WORN!* Hardly able to deliver half the spark it should! Wasting gas . . . wasting money, every time you put your foot down on the pedal!

Yes! You pay $2000 . . . $3000 . . . $4000 for your car. *And a single 98c part robs you of the real power and enjoyment of that car.*

At Last A Plug So Smart That It "Thinks"

Now look at the new plug—*the jet-finish "POWER-FLASH"* plug that I send you—*for only a few pennies* more than you're paying now!

Here is a plug that has not only *ONE* firing point—but hundreds *of firing points!* That fires so fast, so effectively, so often that it actually *ELIMINATES THAT DEADLY CARBON . . . BURNS IT UP . . . THROWS IT AWAY . . . KEEPS ITSELF SPARKLING CLEAN ON EVERY SINGLE STROKE!* The full, blazing horsepower that was there when your car was brand-new, *is still there* 30,000 miles later.

But that's just the beginning! *This plug actually gives you the different firing power* you need for every driving condition — smooth, dependable power for city stop-and-go driving . . . effortless horsepower for the parkway . . . blazing reserve power for super speeds! No more missing, sputtering, knocking when you want to pull ahead of other cars at high speeds! No more groaning take-offs at the lights! *FULL POWER 24 HOURS A DAY . . .* or we send you a new set *Free*.

And that's still just the beginning! Best of all — this is the *jet-finished, strongest, longest lasting plug ever made! YOU COULD ACTUALLY POUND IT AGAINST A CONCRETE WALL WITH A HAMMER WITHOUT EVEN DENTING IT — AND THIS AMAZING PLUG WOULD STILL FIRE CLEAN AND HOT FOR 30,000 MILES!* Yes! These fantastic plugs give you such terrific, consistent, long-lasting service that we can afford to make *one of the most amazing guarantees you ever heard!*

See The Amazing Difference Yourself!

This new "Power-Flash" Hi-Compression Power Plug (on the left) is guaranteed to be the most powerful longest lasting Spark Plug ever made! Here's why:

1. Only "Power-Flash" gives you an unlimited number of firing points — plus a guaranteed minimum of 30,000 more spark action than ordinary plugs! Higher compression, longer engine life, more mileage, power and pep!

2. Only "Power-Flash" gives you automatic heat and gap control! Actually thinks for itself! Gives you faster, wider spark for smoother performance, instant starting, faster pick-up even in freezing weather!

3. Only "Power-Flash" gives you exclusive self-cleaning action! Actually burns plug to clean itself. Plugs run cleaner, cooler, longer! No more fouling "plug" or power loss!

4. Only "Power-Flash" gives you longest lasting quality! Lifetime guaranteed — diamond like hardness! Gets rid of deadly heat up to 10 times faster than ordinary insulators!

Plus this startling guarantee: Satisfaction guaranteed for ten full years or 30,000 miles . . . or a new set free! Act today!

Try It at My Risk, Today!

What have you got to lose? These amazing jet finish *"POWER-FLASH"* plugs cost only $1.45 each — or $8.70 for a complete set for six-cylinder cars, and $11.60 for a complete set for *eight-cylinder cars. They cost only a few pennies more than ordinary old-fashioned plugs—and they can save you up to $100 this year!*

Here is my guarantee to you. Put these plugs in your car yourself. No mechanic needed. Nothing to adjust. From the very first moment that you get back in that car and drive, you must notice amazing new power and pick-up —or I'll send you a new set free!

You must notice new gas savings . . . you must eliminate most ignition knocks and pings . . . you must get instant carbon-free cold weather starting . . . and you must get this thrilling, new-car performance year in, and year-out — FOR TWO FULL YEARS, OR 30,000 MILES — or I'll send you a new set — *FREE!*

You have nothing to lose! *BUT THE SUPPLY OF THESE PLUGS IS STRICTLY LIMITED. THE NICKEL ALLOY WHICH MAKES UP THEIR ELECTRODES IS HELD IN SHORT SUPPLY BY THE UNITED STATES GOVERNMENT. THIS WILL BE ABSOLUTELY THE LAST TIME WE CAN MAKE THIS OFFER! ACT TODAY!*

AMAZING MONEY-BACK GUARANTEE!

Clip this guarantee section out of this page. It authorizes you to try these amazing POWER-FLASH Spark Plugs *entirely at our risk!* First—test them for one full month for *surging power, thrilling new driving performance, breathtaking gas savings alone!* During that very first month alone:

1) These plugs must give you up to 9 miles MORE per gallon — INSTANTLY — *or every cent of your money back!*

2) These plugs must give you up to 20 MORE horsepower — INSTANTLY — *or every cent of your money back!*

And 3) — *as an extra added assurance* — These plugs must continue to give you this power, performance and gas savings—FOR TWO FULL YEARS—*or we will send you a brand-new set, ABSOLUTELY FREE!*

You have nothing to lose! This is probably the most amazing guarantee in car history! No strings! No questions asked! Act TODAY!

FREE BONUS!

Sensational, Nationally Advertised, Car Book Saves You Up To $250 On Repairs This Year Alone!

Over a quarter of a million drivers have paid up to $1.00 for the same expert money-saving handbook! But now IT'S YOURS FREE!

The legendary Car Book that made history by showing millions of economy-minded car-owners how they could save up to $250 a year in costly gas and repair bills. The sensational book that ripped the lid off all the professional tips and tricks known by the nation's trouble-shooters and set me-chanics! Here, are all the eye-opening money-saving secrets that save you dollars after dollars in costly car repairs and upkeep.

Here are simple tips that show you how to add amazing mileage to your car — without touching a tool — without even lifting the hood of your car! Here's a fantastic 30-second trick that gives you up to 2-3-4 miles more per gallon! Another, second shown you how to switch one single wire and save up to 50 gallons of gas in your winter driving . . . how you can add up to 10,000 more miles to your tires . . . how to get your "dead" battery started in just one minute — without a push or a lend!

Yes, professional tips that can save you hundreds of dollars a year! And it's all yours — *FREE!* Here would you like to get power to burn away from other cars at the lights . . . to drive up to 4,000 miles—without changing your oil! Other ingenious tips show you how to remove rust from your chrome . . . make dents and scratches disappear for good . . . to stop steering wheel "play" . . . how to adjust your own brakes and save $6 . . . to repair your clutch yourself and save $15 . . . fix a leaky radiator and save $20!

Yes, all this and more to come—absolutely *FREE* — our *BONUS GIFT* to you with your purchase of the amazing new *"POWER-FLASH" PLUGS* which are absolutely guaranteed for two years or 30,000 miles of the most fabulous spark plug service you've ever enjoyed! But if you want this special *FREE BONUS* — the sensational book "How To Double The Performance Of Your Car" — you must order your *"POWER-FLASH PLUGS* today! Our supply of this free Final Edition of the Car Book is limited! Do act NOW!

HERE'S PROOF!

Users Report Fantastic New Mileage — Breathtaking New Power!

"Your Power Plugs are well on the way to paying for themselves. So far have saved about $6.00 a month on my gasoline bill. As far as I can figure, I am getting 9 miles more per gallon of gas than I used to get.

"Although I did have a new set of spark plugs in my car before replacing them with your Power Plugs, the old plugs made my engine spit and gallop. Now it really runs smooth and starts a lot better, too."

H. G., Dedham, Mass.

"I bought your plugs for my '56 Ford some time ago . . . as far as I can tell I am getting at least 3 miles per gallon better mileage. Also my Ford has far better pickup and horsepower. I have driven about 12,000 miles since I installed the plugs and they are in as good condition as ever."

C. M., Aeolia, Indiana

"I replaced the squeezing type spark plugs in my Lincoln Continental with yours. With the old style plugs, I was getting approximately 15 miles to the gallon. During the first thousand miles of operation with Power Plugs, my mileage increased to 22 miles per gallon. This was an increase of 7 miles per gallon. In addition to the increased mileage, I was happy to notice much better idling and absolutely no stalling. Hills which I formerly took in second gear now present no problem in climbing with high gear. My Henry Continental used to lose away from signals; now it dashes away."

D. C. W., President Exporting Co.

A BOSS MECHANIC SAYS:

"I earn my living repairing automobiles. As a master mechanic I have installed all kinds of spark plugs over the past 18 years. You boys really have something. I have never seen a plug before that fires as true and hot and on our test equipment, every installation has shown a big increase in horsepower as much as 20% in some cases. For the boys who want more power and better pickup, you have the answer."

J. C., Magnolia, Arkansas

"Your plugs have been in my car now for three or four months, and I must say it's running better than it ever did before, and I am getting a lot better mileage out of it. At least as much as the 15% you claim."

"I'd say your plugs are well worth the price you ask, especially as I do not expect to have to buy a new set as long as I have my present car—a 1950 Mercury."

B. H. D., Chicago, Ill.

20,000 MILES WITHOUT A SINGLE ADJUSTMENT

"I have just disposed of the car in which your spark plugs were installed. The following facts may be of interest to you.

"Speedometer reading, mileage at installation—27,750—mileage at this date — 64,334. No replacement nor adjustments since installation and plugs giving perfect service."

G. K. H., Indianapolis, Indiana

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Please fill in the entire coupon. PLEASE PRINT!

Gentlemen: Yes, I want to try your amazing "POWER-FLASH" jet finish Spark Plugs entirely at your risk! I will pay postman only amount checked below plus low C.O.D. charges.

☐ $8.70 for a matched set of six "POWER-FLASH" Spark Plugs. ☐ $11.60 for a matched set of eight "POWER-FLASH" Spark Plugs.

I understand that these "POWER-FLASH" Plugs must give me more power, tremendous new performance and gas savings — more than equally do everything you say for a period of 2 FULL YEARS or 30,000 MILES — or I may simply return them for a NEW SET FREE.

Also send me as your Extra Gift Premium, the Free nationally advertised car-book, "How To Double The Performance Of Your Car." This book is mine to keep as a Free Gift even if I return the plugs.

MAKE OF CAR _____ YEAR _____

MODEL _____ NO. OF CYLINDERS _____

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

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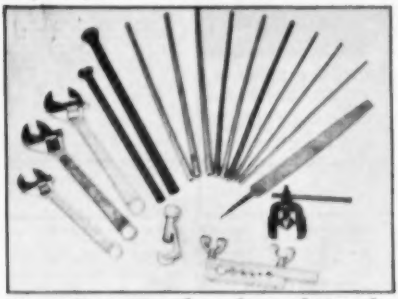

You Get Professional Tools

Here are tools included in just one kit. You get other tools, tubing, much equipment. Tools develop your interest and skill, speed up training.

You Learn in Easy Stages

Another kit, which includes motor, fan, pulley, service tools. Kits are sent on a planned schedule to help you learn in easy stages. There's no other training like this!

R. C. Anderson
President CTI

A GOOD JOB, MORE MONEY, BRIGHT FUTURE—all three can be yours in the Air Conditioning & Refrigeration field! *Thousands of mechanics are needed* to repair and service the 150 million units in use—and the six million air conditioners, freezers and refrigerators that are produced each year. You can earn more money in a better job—if you are trained. For information on how to get this training, *just fill out and mail coupon below.* No obligation!

A New, Easy Way to Learn in Months

CTI training is quick and effective because it is *practical.* You learn by doing. During the course of your training, you receive 23 big kits, including tools. You practice with these kits, get valuable experience. For instance, *you do 10 complete service and trouble-shooting jobs with CTI kits.* You assemble a heavy-duty, commercial type, ¼ h.p. high side (illustrated at left). You build an air conditioner, refrigerator, freezer or milk cooler—and you keep and use this valuable unit! Only CTI sends you these fine tools and kits—helps you get real *on-the-job* training! And all this fine equipment is yours at *no extra cost!* With CTI training you can *start out* as a mechanic and avoid years of work as a lower-paid apprentice.

Earn Good Income as You Train, too

CTI training is so practical that students often work in spare time repairing air conditioners and refrigerators. *They add to their income this way.* Some get jobs with local dealers; others work on their own. Many students go in business on graduation. A number get full-time jobs while they're students.

A Wonderful Opportunity to Be the Boss

If you want to own a business, Refrigeration offers you opportunity for success. Since most jobs are service calls, you can build up a list of potential customers. Very little capital is needed to start.

Mail Coupon For Two FREE Books

Mail coupon below for two books which give you complete information. One is entitled *Success in Air Conditioning and Refrigeration.* The other is a *Lesson Sample.* Both FREE.

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Mr. R. C. Anderson, President — Dept. R-347
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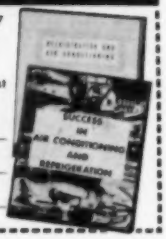
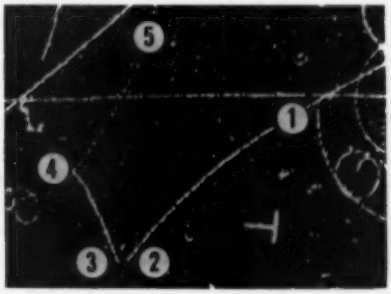


You ought to know...

Is this the breakthrough on H-power? A newly found "trick" makes atoms join together and release energy without the sunlike heat that until now has been thought necessary (see page 124). It seems parallel to the 1939 discovery of an easy way to cause fission, which made A-power practical. Like the fission process, the new fusion method suggests a simple-to-sustain power reaction.

Dr. Luis W. Alvarez (atom and radar expert, inventor of the GCA blind-landing system) and 11 associates at the University of California get the credit. They studied 75,000 photographs of the bubble trails that charged atomic particles make in a chamber containing liquid hydrogen. They found that 15 pictures recorded an unusual reaction—one such is reproduced below. Here is their interpretation of the queer white streaks:

The long curved track (1) is a mu meson, one of the basic parts of the universe whose role is still unknown. Mesons are found naturally among cosmic rays, but can be manufactured in very big atom-smashers, as this one was. The meson, negatively charged, combines with the positively charged core of a special variety of hydrogen, heavy hydrogen, to form a neutral "atom" (2). This mesic atom drifts a bit but leaves no track because it has no electrical charge. Then it meets a core of ordinary hydrogen (3) and combines with it to form the core of a new atom—helium. The helium core weighs less than the two hydrogen cores that formed it, and the excess weight appears as energy—fusion power. Meanwhile the mu meson gets kicked out (left-curving track) and quickly changes (4) into an ordinary electron, which flies out of the picture (5). In some photographs like this one, a single mu meson catalyzes two reactions; after being kicked out by the first fusion, it fuses another pair of hydrogen cores.



The trouble is that mu mesons don't last long enough to keep such a reaction going for power production. But maybe there is another particle that is like the mu meson, yet lasts longer. A Russian physicist named Alikhanian thinks he has found one. If he is right, the power plant of the future may be a big container of hydrogen gas, with a meson-generating atom-smasher to get it started. There's plenty of hydrogen, ordinary and heavy, for fuel —the oceans are full of it.

This spring looks like the time to build your new house—if you're pretty sure of your finances. Here's the story:

1. Materials are in excellent supply, lumber almost in over-

You ought to know...

supply. Because fewer houses are being built this year, skilled labor will also be obtainable—though not necessarily any cheaper.

2. "Tight" money will be really tight. This means you'll have difficulty getting any kind of mortgage, you'll need a bigger cash down payment, and you won't get a break on the interest rate.

3. The important thing now, though, is: Don't build too small. You'll want at least three bedrooms, 1½ baths—not so much for your own family (you may not need the room) but for *guaranteed resale value.* The reason is simple. So many more families are now having third and fourth children that small homes are going to be white elephants.

Twice as many men die of heart disease in New York as do in New Mexico. How come? It's not just city life that causes the wide variation in heart failures from state to state (see chart below). Differences in diet, exercise, stress, heredity, and the physical makeup of local populations are involved. Heart experts are now analyzing variations within the states, in an attempt to pin down the causes—and eventually a preventive—for heart disease, the leading cause of death . . . Get your polio shots now. Plenty of Salk vaccine is available; two inoculations this spring will give considerable protection before the polio season comes. Only one out of six young adults—20 to 35 years old—has had any vaccine yet. Adults are definitely susceptible to polio—and when they catch it, they really get a bad case.

The fracas in the Middle East means that more and bigger tank ships will be built to supply an oil-starved world. Two super-super tankers—around 100,000 tons displacement—are already in the works: one to be built in the U. S. for the Onassis interests, the other to be constructed in Japan for National Bulk Carriers, which now operates the world's biggest tanker, the 85,000-ton Universe Leader. And a Japanese outfit, Mitsubishi, is toying with the idea of an atom-powered submarine tanker—it could glide serenely underneath the terrible surface storms that often plague the western Pacific. This would be the first cargo sub since the German Deutschland of World War I.

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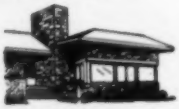

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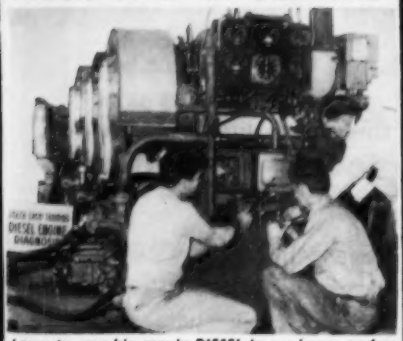

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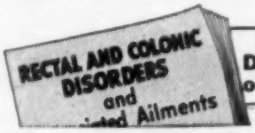

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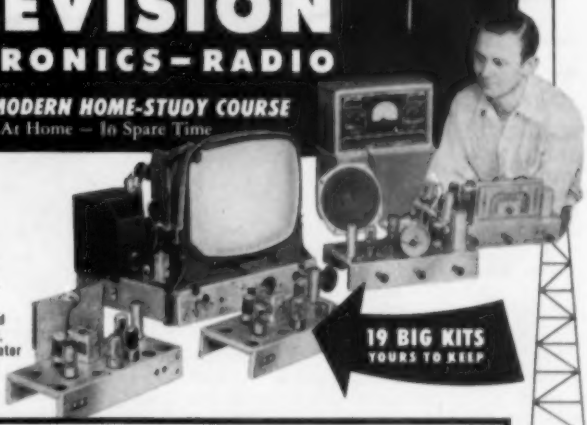

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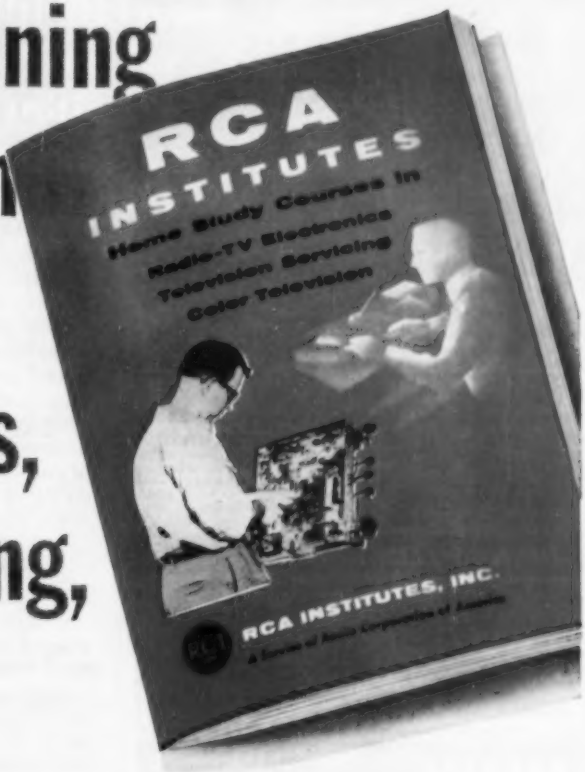

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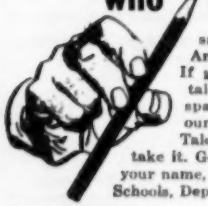

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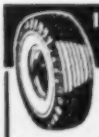

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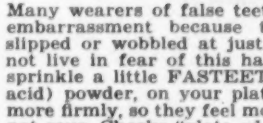

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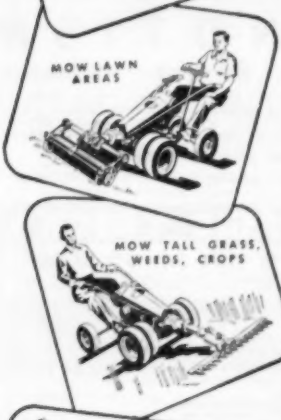

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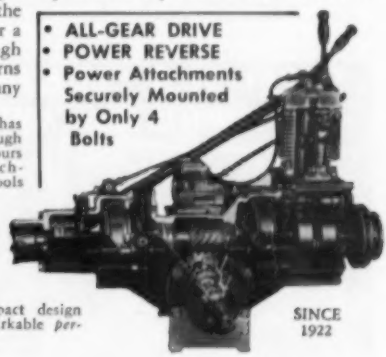

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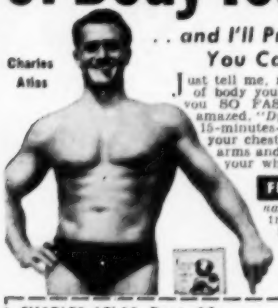

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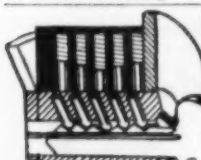

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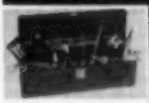

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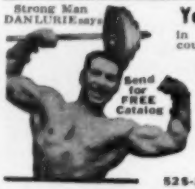

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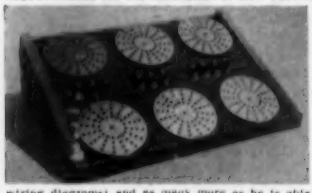

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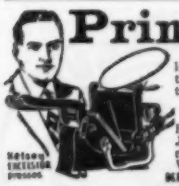

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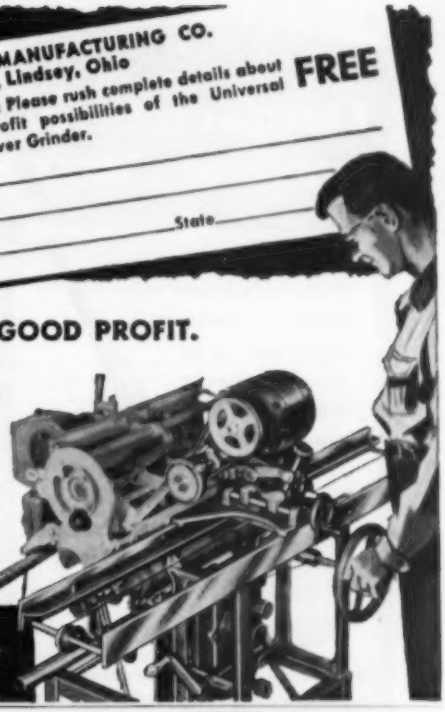

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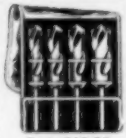

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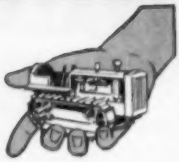

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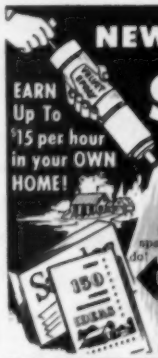

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700-16	5.78	800-15	5.68	900-20	14.58	700-15(6)	6.88
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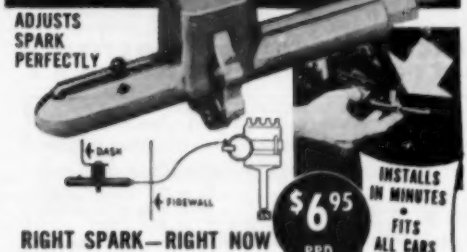

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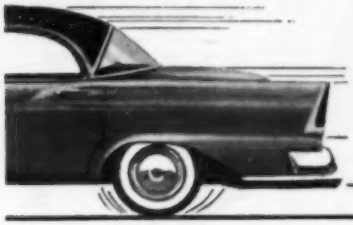

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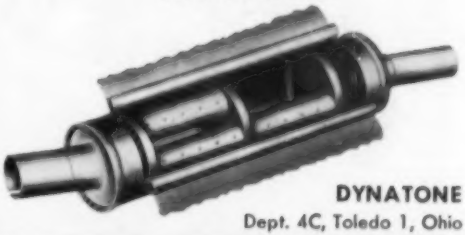

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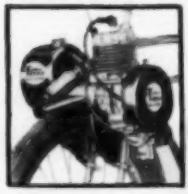

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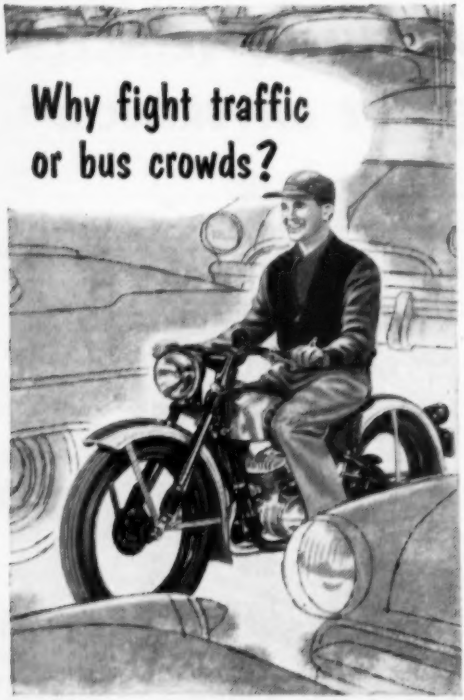

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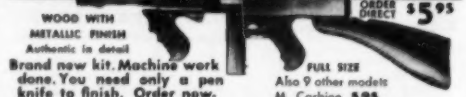

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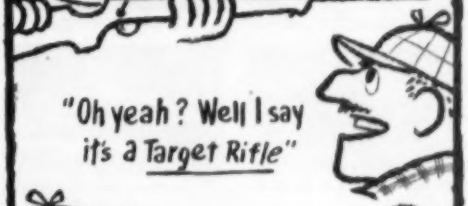

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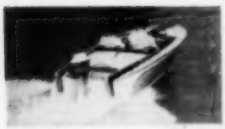

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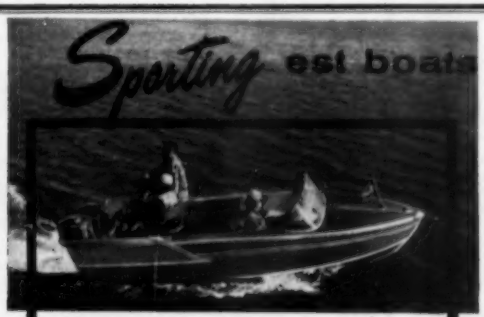

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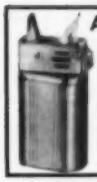

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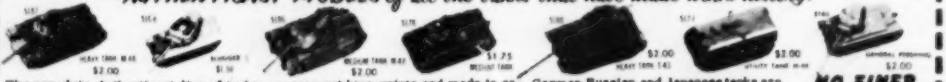

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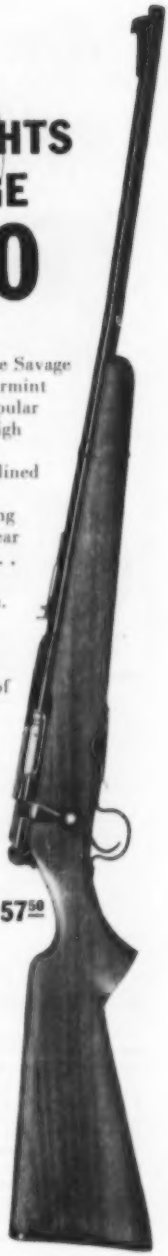

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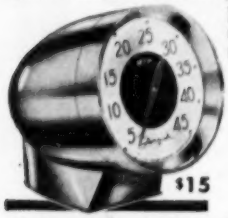

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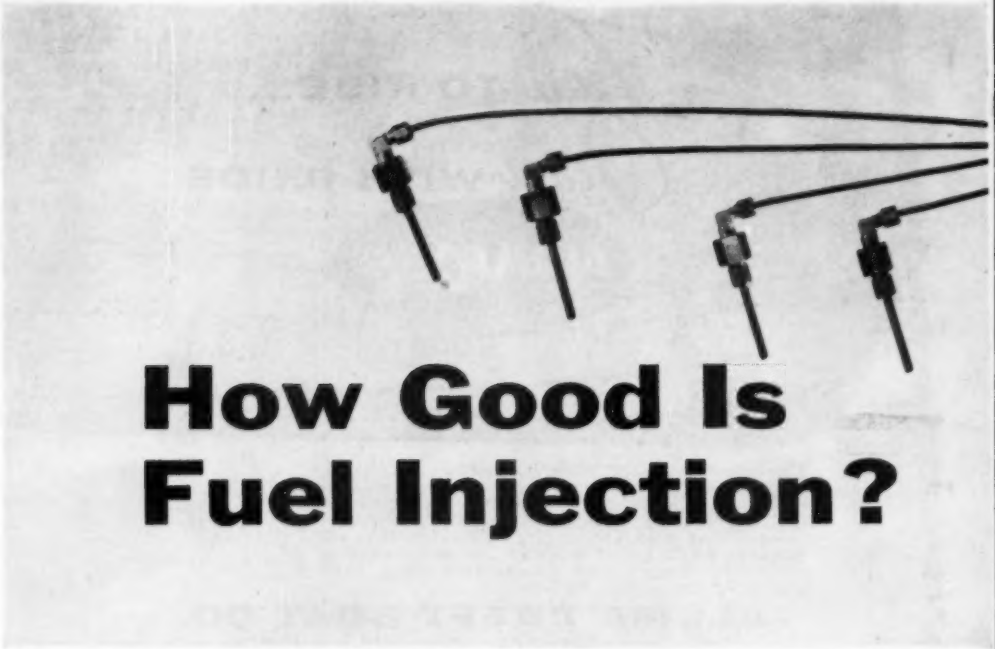

How Good Is Fuel Injection?

By Harry Walton

ONCE you drive a fuel-injection car, others feel sluggish. That alone is enough to enter it in Detroit's horsepower sweepstakes. But fuel injection has other important advantages for the car owner.

- It can deliver better gas mileage than a carburetor.
- It can give good performance on low-octane fuel.
- It eliminates almost all backfiring, icing and vapor lock.
- It makes cold engines start faster and warm up sooner.

Its drawbacks? Most of them are either licked, or can be. The toughest is cost. Fuel injection is still expensive.

You can get it right now as an option on a Rambler Rebel or a Chevrolet V-8. You may see Pontiacs with fuel injection on the road; a limited number are being supplied as dealer cars. Meanwhile, makers of FI systems are plugging them hard in Detroit, and most car manufacturers are researching their own.

Historically, fuel injection isn't new. The great grand-daddy of your lawnmower engine, built by C. N. Teetor in 1896, had a squirt system. Rudolph Diesel found it the ticket for his compression-ignition engine before the turn of the century. Diesel engines have used it ever since.

Gas engines are different. A diesel throttle controls fuel only; cylinders gulp all the air they want, at any speed.

Gasoline situation got you worried? Then also read two articles following this:

"How I Taught My Wife To Save Gas".....**Page 94**

"Are We Running Out of Oil?".....**Page 99**

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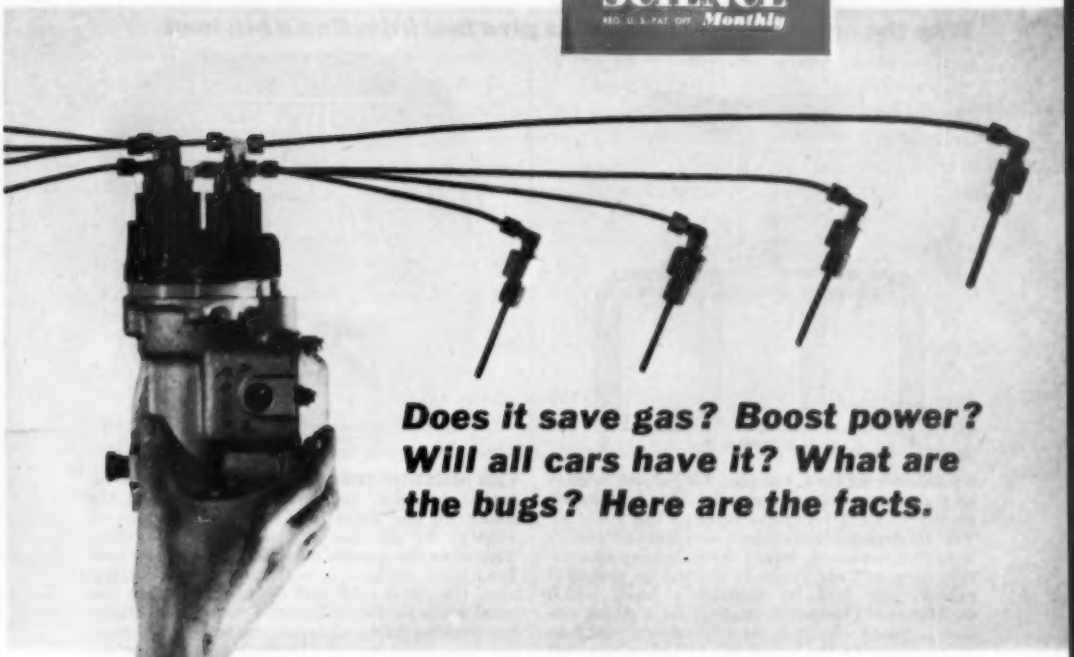


Does it save gas? Boost power? Will all cars have it? What are the bugs? Here are the facts.

PHOTO BY W. W. MORRIS

With gasoline, you have to meter air to fuel in a 15:1 proportion (by weight) or you get poor combustion.

Metering injected fuel is a job that makes a hypodermic needle look coarse; in a car engine you may have to dole out a sixth of a drop at a time for smooth idling. An injection system must also provide quick starting whether the engine is stone cold, just warm or hot. It must squirt extra gas for a getaway or flashy pass.

But carburetors do all this. Why change? Because, a Chevrolet engineer told me, we've just about reached the peak of carburetor performance in the multibarrel jobs. Said another engineer, at the Eclipse Machine Division of Bendix (which makes carburetors as well as an electronic fuel-injection system), "Multibarrel carbs are only a crutch."

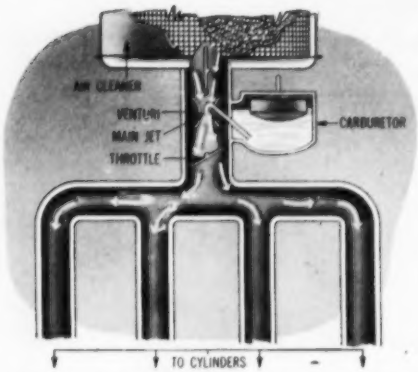
A spokesman for the Rochester Products Division of GM (which developed the injection system used on the Corvette) felt otherwise. "Even with all the potential advantages of fuel injection," he said, "the carburetor will have a place for years, may never disappear completely."

That the carburetor will die hard is suggested by the dual quad (two four-barrel jobs) on the 245-hp. Ford, and by the triple two-barrel carburetor setup on the '57 Olds. Superchargers, now Ford and Studebaker options, will give a carburetor-fed engine plenty of moxie.

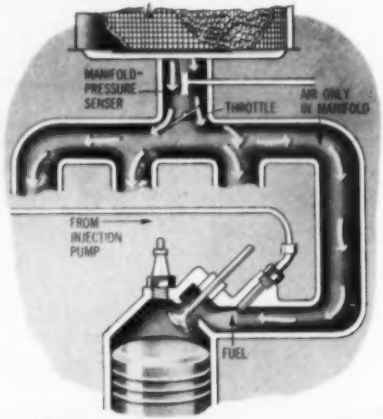
But that there is still room for improvement in manifold design, carburetor men are the first to admit. For example, it's possible to "tune" a manifold in resonance with engine breathing to get a ram action or supercharging effect. There are possibilities in pressure carburetors. These atomize fuel by pump pressure instead of suction, and so supply plenty even at minimum manifold vacuum (as when an engine is lugging in high). Because gas can be vaporized anywhere in the manifold, you escape icing, hot-spot and fuel-level problems.

On cost alone, carburetors should stay

Why the carburetor's drawbacks give fuel injection a big lead



AS ENGINE DRAWS AIR past carburetor venturi or throat, pressure there falls. This lets atmospheric pressure force gas through the main jet. The air stream breaks it into droplets and carries it to the manifold, where heat helps vaporization. Engine's air intake is limited by practical venturi size and by manifold's heat, which expands air (reducing quantity in a given volume). Some elements in modern gas tend to separate out in the manifold; cylinders may get different octane values. Changing bowl level due to car motion may affect fuel delivery.



FUEL INJECTION IS IMMUNE to many of the carburetor's troubles. Only air passes through the manifold, and there is no need to maintain air velocity to produce a venturi pressure drop. Therefore the manifold can be made big for easy breathing. As heat is not needed for vaporization, the air is cold and dense; the engine can pack more in. Being injected near the cylinder, gas remains fluid and homogeneous; all cylinders get like amounts, of identical octane number. The throttle won't ice up because, unlike a carburetor system, gas is not vaporized above it.

around for a while. Right now FI will nick the budget for about $500 extra.

What puts FI ahead? The showiest advantage is a boost in power; conservative estimates put it at seven percent for standard engines. Nash claims a whopping 13 percent for its new 327-cu. in. Rambler Rebel—from 255 hp. with a four-barrel carb to 288 hp. with injection.

The power gain comes early. Peak torque or turning effort occurs about 500 r.p.m. sooner than with a carburetor. You get more go in the acceleration range: The engine can breathe better; there is no big venturi to hamper air flow; the air is cold (in a carburetor it's heated to help vaporize gas). Cool air is denser; you can pack in more per stroke.

FI puts fuel in close to the cylinder so it doesn't separate into different octanes. Each cylinder gets the same diet.

Can FI save gas? A Lincoln test engine run by Du Pont's Petroleum Laboratory showed almost 14 percent better gas mileage with FI at 60 m.p.h. load than with a carburetor. The conservative driver, a Bosch engineer told me, might save 15 to 25 percent. Even a lead-footed type should save at full throttle.

An injection system cuts off all gas on deceleration and coasting. That saves fuel and avoids loading the muffler with raw gas. The instant the engine returns to idle or load, gas flows again.

Bonus advantages of FI are that it's impervious to cornering and hard braking, which may affect carburetion by changing the bowl level. It can live on a poorer octane diet; Du Pont engineers retarded timing seven degrees, fed their engine gas five octane numbers lower than with carburetion. It delivered the same power.

When will FI really arrive? It's rumored that certain 1958 engine designs —already frozen—include fuel injection. A Bosch executive told me that he expects FI to be standard on some luxury

cars in 1958, and that in five years it may be as common as automatic drives.

But some auto men want more research. A Chrysler engineer said, "We are enthusiastic about it, but haven't yet found a system cheap and dependable enough. We want one that will give more operating economy than the carburetor, and that can be serviced by any machanic."

It's common Detroit talk that Cadillac tried an FI system on the $10,000 Eldorado, but reluctantly passed it up for 1957 as not yet foolproof.

How does FI work? True fuel injection, as used on diesel engines, squirts fuel directly into the combustion chamber. Cylinder injection requires high-pressure pumps, and nozzles that can stand combustion heat and pressure. Most FI systems developed in this country squirt gas in just behind the intake port. Injection pressure can be lower, and nozzles are cooled by inrushing air and fuel.

Some FI systems time injection to occur during the intake stroke. Others, such as the GM-Rochester unit used on the Chevrolet, spray continuously from very small nozzles. Fuel enters the cylinder only when the intake valve is open.

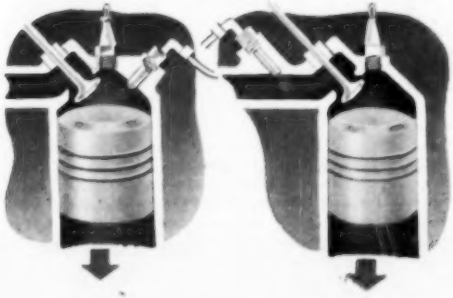
The total amount of fuel is metered according to engine needs by the pump, and to individual cylinders by the nozzles. These must be in matched sets (to avoid overfueling some cylinders while starving others). The fine orifices (11 or 12 thousandths of an inch) require special filters to prevent clogging.

A Corvette with the GM-Rochester system that I tried proved rough at idle (it had a high-lift cam). But it delivered a terrific kick of acceleration at 60, 70 and 80 m.p.h., with plenty of go left at 100.

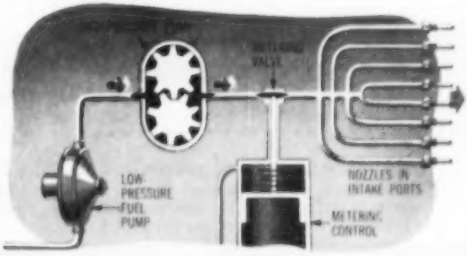
Timed systems have to meter fuel in one-lung doses. The American Bosch Arma unit (PS, Feb. '56) has a single ingenious pump that times, meters and distributes the gas. Although the Bosch-equipped Thunderbird I tried couldn't show its heels in Springfield streets, it did zip away from lights with notable vigor, and still ticked over politely at idle.

Simmonds Aerocessories of Tarrytown,

Fuel can be injected into the cylinder or at the intake port

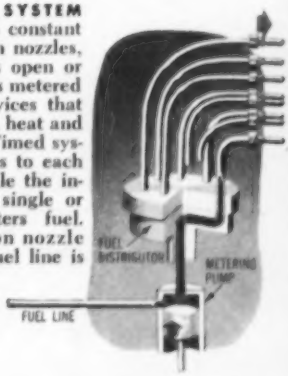


Flow of fuel may be continuous or timed with intake valves

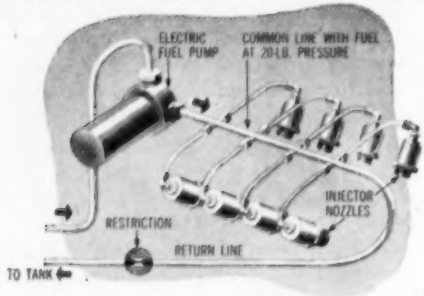


TRUE FUEL INJECTION, as used on diesel engines, squirts it directly into the combustion chamber of the cylinder (above, left). It can deliver fuel even during the compression stroke. Port injection (above, right) gets gas in only while the intake valve is open. Both systems work equally well up to about 5,000 r.p.m. Above this speed, the intake valve is open so briefly that port injection cannot deliver a full charge of fuel. Cylinder injection is the type favored in Europe, where engine speeds are generally higher than the r.p.m.'s Detroit builds into its products.

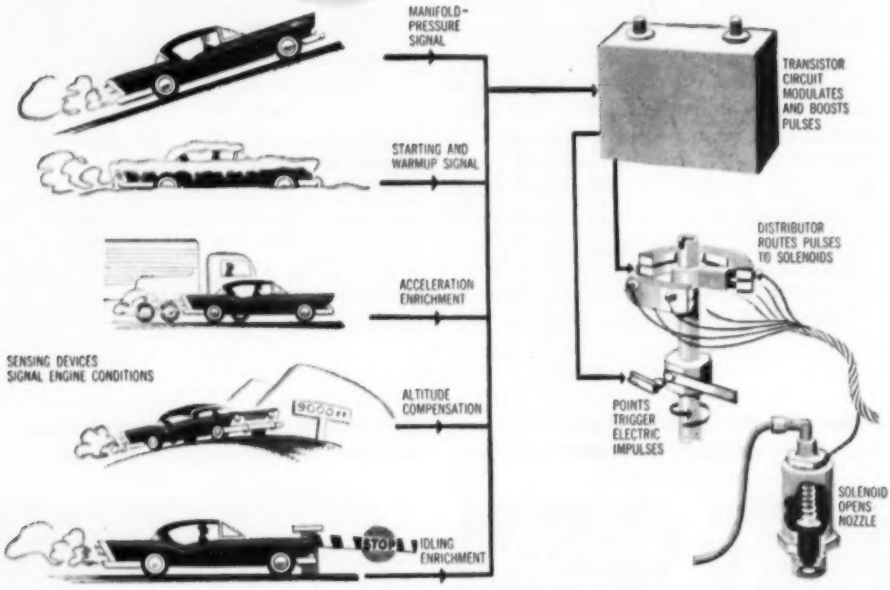
CONTINUOUS-FLOW SYSTEM shown above supplies a constant fine spray from injection nozzles, whether intake valve is open or closed. Amount of fuel is metered to engine needs by devices that sense manifold pressure, heat and acceleration demands. Timed system (right) delivers gas to each nozzle in turn only while the intake valve is open. A single or multibarrel pump meters fuel. Valve in each injection nozzle opens only when the fuel line is under pump pressure.



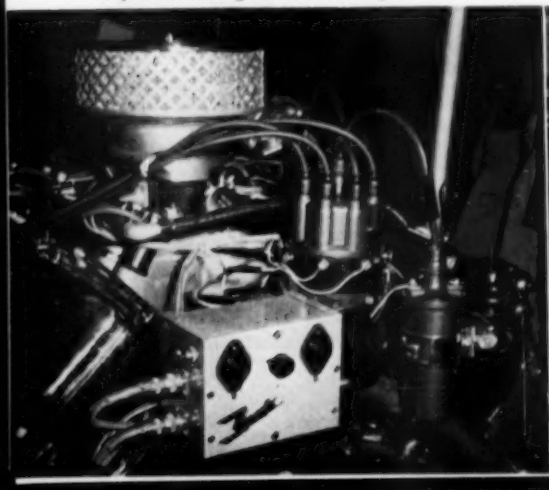
The Bendix injection system times its shots electronically



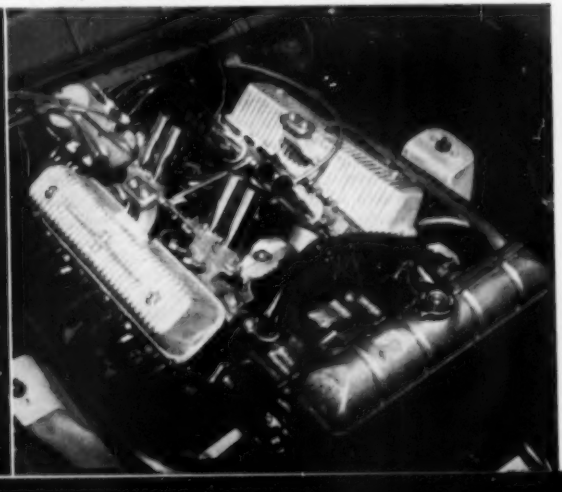
FUEL IS PUMPED to injector nozzles through a line that returns surplus to tank. Nozzle valves stay shut until current flows through their solenoids; the length of time these hold the valve open controls metering, or fuel quantity. A distributor-breaker unit sandwiched under the ignition distributor times electric pulses with the opening of the intake valves. An electronic circuit stretches these pulses out according to engine needs, and the distributor routes them to nozzle solenoids. On coasting and deceleration, no gas is wasted—all fuel is cut off.



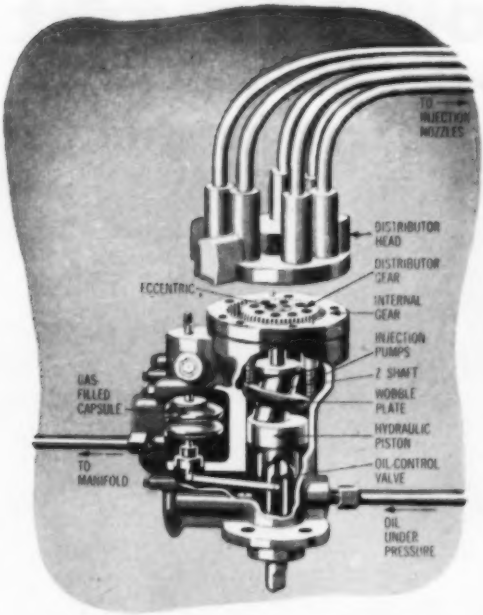
ELECTRONIC INJECTION SYSTEM on a Rambler engine shows transistorized "brain box" and the extra distributor under ignition distributor head. Injection wiring uses low voltage.



FAST FORERUNNER of injection systems in this country was the Hilborn racing-car unit. As shown on a Mercury, it has a throttle body on each cylinder. Feed is by continuous flow.

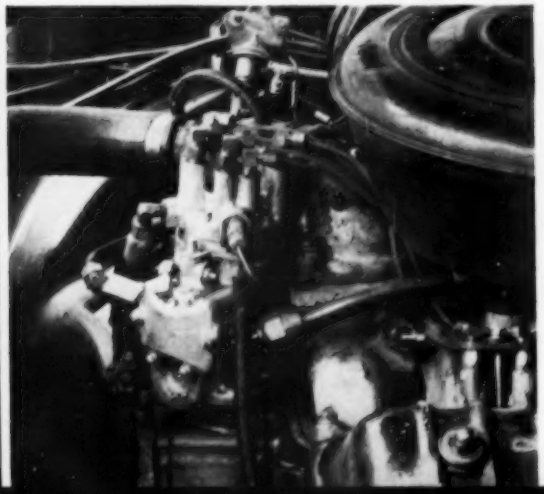


This pump has four barrels



TURNING AT ENGINE SPEED, an inclined "Z" shaft actuates a wobble plate, forcing four spring-returned pump pistons up in turn. A distributor gear rotating within an internal gear at an 8:9 ratio alternately lines up first one and then the other of two delivery ports above each pump, so feeding eight cylinders. Fuel metering is controlled by manifold-air density and temperature, which affect a gas-filled capsule that valves engine oil to a piston on the Z shaft. Moved up or down, this shortens or lengthens the pump stroke. Simmonds Aerocessories makes this unit.

DRIVEN OFF TIMING GEARS at crankshaft speed, the Simmonds pump can inject fuel during a 180° period. Injection nozzles have spring-loaded valves that open under pump pressure.



N. Y., with much experience in FI for aircraft and ordnance use, offers a version with four pumps on one shaft.

A '56 Lincoln test car with the Simmonds system took off with high-performance zip every time I nudged the throttle. Floorboarding it caused no stutter; false starts in automatic high (with the throttle bucking the brake) never once stalled the engine.

First application of electronics to an automobile engine is claimed by the Bendix injection system. Fuel is under constant pressure but sprays from the nozzles only when an electric solenoid in each lifts a valve.

A transistor circuit that reads manifold pressure, engine heat, acceleration demands and even altitude correlates all these and chops the nozzle-opening pulse to deliver as much gas as needed. The transistors require no warmup and have an indefinitely long life.

A Bendix-equipped Chrysler was both silky smooth and flashy. Floorboarded from a dead stop, it spun wheels on the takeoff. It pulled smoothly at a walk.

"Nice going," I said to Robert W. Sutton, Assistant Chief Engineer. "But what happens if your electric pump quits?"

For answer he switched off ignition and yanked the fuse from the pump circuit. A dash gauge that had been indicating fuel-line pressure stayed at zero when he turned the key back on. The starter ground over—and the engine came to life.

In high, Sutton nursed the throttle to keep manifold vacuum up. Whenever he stepped on it too hard, dropping vacuum below nine inches, the engine cut out. When he let up, it kicked in again. We rolled at 60.

"How come?" I asked.

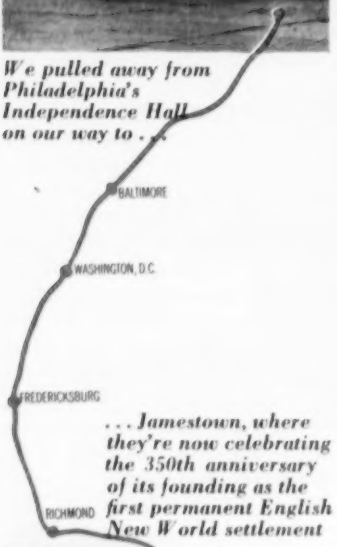
"Manifold vacuum pulling gas through the injection nozzles," Sutton explained. "We could drive for hours with a dead fuel pump. Temporarily, we're running on what amounts to eight small carburetors."

Carburetors? What are they? Fuel injection isn't just around the corner. It may be under the hood of your next automobile. END

How I Taught

It took nerve, but I showed her how smart

We pulled away from Philadelphia's Independence Hall on our way to . . .



. . . Jamestown, where they're now celebrating the 350th anniversary of its founding as the first permanent English New World settlement

"There you go!" I exclaimed impatiently. "Stepping on

By Devon Francis

I SAT there in the right front seat of the car, annoyed. My wife punched the accelerator. Then she hit the brake. Then she punched the accelerator. Then she hit the brake. She was wasting gas.

"Do you know how many times you've used your brake in the last 10 minutes?" I asked finally.

She's the cheerful type, Rosemary. "Shall I guess?" said she.

"Twenty-nine times," I said.

"You counted!" she exclaimed.

I had. I had been counting since soon after we pulled away from Philadelphia's

My Wife to Save Gas

driving could give us $50 a year more spending money.

the accelerator when you can see that the traffic light up there is just about to turn red!"

Independence Hall on our way to Jamestown, Va. Traffic was fairly heavy, but her braking was plainly excessive. It added: too much accelerator, too much brake.

We had three aboard—well, four, counting Schnapps, the dog, who never has been told that he's only a dog, and acts accordingly. Hubert Luckett, of the POPULAR SCIENCE photographic staff, lolled, characteristically silent, in the rear seat.

Our mount was a 215-horsepower 1957 Plymouth sedan. It had two extra drains on its power output: a three-speed automatic transmission and power steering.

"Twenty-nine, eh?" my wife was saying. "Okay, 31—keep the dog on your side of the seat, 32—Schnapps, get over!"

Well, you learn to live with things like that.

Suddenly I got an idea. Leaning over, I took the reading off the odometer and deducted a couple of miles for the distance we had come. The gas tank had been full when we started.

"What's that for?" asked my wife as I straightened up.

"Checking mileage to Jamestown," I lied.

"Don't trust him," said Luckett, closing his eyes. "He scares little children."

I noted the time, deducted 12 minutes.

Presently we were out of the jam-

Bad driving habits mean more trips to the pump

My wife punched the accelerator. Then she hit the brake. She was wasting gasoline.

She failed to watch traffic, got boxed in behind a truck and had to pull up short.

A showy getaway when the light changes is fun—but an awful pain in the pocketbook.

On hills, Rosemary was inclined to feed the engine more gas than it could use.

packed traffic. There were traffic lights, but not so many.

"There you go!" I exclaimed. "Stepping on the accelerator when you can see that light's going to turn red!"

"Maybe you'd like to drive," responded my wife generously.

I had overstepped myself. "No," I said, "you're doing fine, just fine."

Luckett, eyes still closed, asked, "You want to drive from back here?"

I subsided.

My wife was on the accelerator, then off it. She'd lose speed, then hit the gas to regain it. She'd floorboard the throttle. That threw the machinery into a lower gear. That sped up the engine. That cost gas. I bit my tongue.

We overnighted in Alexandria, Va. At dinner my wife suddenly said, "It's the dog. He gets in the way."

I said, "We'll put him in the back seat tomorrow."

Luckett said, "You keep that beast up front."

My wife had a point. Schnapps, a Miniature Schnauzer who demands an umbrella in wet weather, *was* all over the seat. He'd had distemper as a puppy, and in the inevitable babying got irrevocably spoiled. Five minutes after lights went out that night, I felt—as usual—four feet hit the bed, then a cold nose in my ear.

"Why can't you teach that dog some manners?" I said.

"Look who's talking," gurgled my wife.

It was a cold night. I pulled the blanket over Schnapps.

We filled the tank the next morning. It ate up 11.5 gallons. I boarded the right front seat, Luckett sought the roomy comfort of the rear.

"Again?" asked my wife. "Lucky me!" She was enchanted with the car.

"You're doing fine," I said.

Again she was on the accelerator. On hills she fed the engine more gas than it could use. She failed to look ahead for red lights and speed zones. So

I jawed, "Don't you realize three miles more to the gallon would make a difference of $50 a year in our gasoline bill?"

she had to use her brake. She failed to watch traffic, got boxed, had to brake. In utter innocence, I'm sure, she also exceeded the posted speed limits.

Luckett was snapping pictures, his face impassive. My wife glanced at him in the rear-view mirror.

"You two are up to something," she said.

"Such as?" asked Luckett.

"Oh," said she absently, "such as proving what lousy drivers women are."

We reached Jamestown in midafternoon. At a station nearby, I refilled. The tank took 15.5 gallons.

At dinner I began figuring with a pencil on the menu.

"What's the verdict?" asked Luckett.

Including some sightseeing driving around Washington, D. C., we had

When I took over, I checked the tires . . . and pumped all of them up to 28 pounds.

Then I topped off the gas tank . . . Luckett said, "Want to make a little side bet?"

How You Can Get More Miles to the Gallon

A few simple driving practices can boost your gas mileage 25 percent or more:

- From a dead stop, ease in on your accelerator. Keep your engine speed low. And shift into high fast.
- Stay off your brake.
- In traffic, use just enough accelerator to drift to the next light.
- Stay off your accelerator at stops.
- On the open road, drive at 60 or under.
- Keep a fixed throttle.
- Drive ahead of your car—close your throttle well short of red lights and speed zones.
- Avoid getting "boxed."
- Slow down if wind is against you—its resistance goes up as the square of speed.

For the automotive handyman, attention to a few car and engine details will pay off in better gas economy:

- Carry about six pounds more in your tires than the car manufacturer specifies.
- See that your wheels are "free"; jack them up and turn them by hand; check your wheel-bearing adjustments; make sure that your brake shoes are not dragging.
- Install a thermostat that will bring your engine temperature up to operating efficiency quickly.
- Keep plugs and points clean; check the wear on your points; gap your plugs.
- Use a light engine oil.
- Adjust your idle just above the point where your engine will stall.
- Advance the spark to the point where a slight detonation occurs on steep grades.

covered 337.8 miles on 27 gallons of gas. My wife's average had been 12.5 miles per gallon. Allowing for stops, her average speed had been 39.1 miles an hour.

As a matter of fact, she had not done a bad job of driving. Whatever offenses she had committed were being committed by millions of other motorists every day.

"Hmm," mused my wife, "so *that* was it!" Then she beamed. "Pretty good, eh?"

"For speed, yes," I said. "For miles per gallon, it's awful."

"Oh," she said, "*that*."

"*That*," I repeated indignantly. "*That* is important!"

"Maybe," said Luckett, baiting me, "maybe you could do better."

"I can," I said. "It's simple."

"Like keeping the dog off the bed at night?" asked my wife.

"I'll bet you a new hat that I can do a lot better," I said.

"How much?" she asked.

I got reckless, "Three miles a gallon."

I always misread women. "I mean," she said, "how much for the hat?"

"I'm going to do even better than three miles," I stated. "Forget the hat."

"Five will get you 10," put in Luckett, "that she gets the hat anyway."

I was smarting. That night I jawed, "Don't you realize that three miles more to the gallon would make a difference of $50 a year in our gasoline bill?"

"Umm," drowsed my wife.

I could better her gas mileage, I knew. It would be a breeze. But by how much was something else again. When I had said three miles a gallon, it had been sheer bravado. I wasn't acquainted with the car. It had been borrowed for the trip to Jamestown, which this year celebrates the 350th anniversary of its founding as the first permanent English settlement in the New World.

As the lights went out, I felt a cold muzzle in my ear.

Two days later we got ready to start back. I checked the tires. The left front and left rear held 19 pounds, the right front 18 and the right rear 22. I pumped all of them up to 28. This was six over the manufacturer's spec, but would reduce road friction.

At a Plymouth dealer's in Williamsburg, near Jamestown, I asked a mechanic if he had any ideas for saving gas.

"Sure," he said, "take out that automatic shift and put in a manual box."

"No, you don't!" interposed my wife. "You drive that car in the same condition that I did!"

I topped off the gas tank. I figured on a substantial gas saving in the ac-

[Continued on page 238]

Are We Running Out of Oil?

What fuels will your car and oil burner be using 10 years from now? How promising are coal and shale as major sources? An expert answers your questions.

By Richard M. Machol
Managing Editor, Petroleum Week

THE Middle East crisis has raised a worry in many people's minds: Will we always be able to get enough oil to satisfy the great and growing demand?

The flat answer to the question is: "No, there won't always be enough oil."

But don't get too upset. There's still no reason for you to get rid of your car, or to convert your oil furnace to coal. There are many things that can be done to stretch the available supply.

Here, in question-and-answer form, are some of the key factors in the oil picture:

Just how much oil is there, in all?

No one knows, because no one can even guess how much undiscovered oil exists. We may have found just about all the oil there is. Or there may be still undiscovered pools that will dwarf anything found so far. Or the truth may (and probably does) lie in between.

The only thing we can even guess is how much oil there is in the deposits we have already discovered.

Guess? Don't you know?

No, it's still a guess. When you find oil in new territory, you can't travel two or three or four miles underground to measure it. You have to go by certain hints, such as the thickness of the oil sands, the rate at which the oil flows, and the area of the field (as determined by subsequent drilling) to reach an estimate of the oil in your field.

Another obstacle: There's no way of getting all the oil out of the ground. Oil

AN OIL WELL IS BORN in Wyoming. Man on derrick is pointing to first visible squirt.

men talking of an oil "pool" don't mean a mass like water in a lake. The oil exists in the crevices of rock formations, such as limestone and sandstone. No matter how efficient the recovery method, there's bound to be a lot of unrecoverable oil.

When an oil man talks of reserves, he means first, that they're proved—that is, they're known to exist, and second, that they're recoverable by present methods.

All right, then. How much oil is there in proved, recoverable reserves?

Perhaps as good a figure as any is an estimate made about a year ago by Wallace A. Pratt, a retired vice-president of Standard Oil Co. (N. J.), and a recognized expert. He put the free world's total reserves at 306 billion barrels including 35 billion in the United States and 230 billion in the Middle East, around the Persian Gulf. Add to this the estimate by other petroleum geologists of some 11 billion barrels of reserves behind the Iron Curtain, and the total is 317 billion barrels of proved world reserves.

How fast are we using it up?

At the rate of about five billion barrels a year. It's been estimated that by 1965, demand will nearly double, to perhaps 8¼ billion barrels a year. And by the end of the century, that's apt to quadruple.

Then won't we run out of oil before the end of the century?

No. For one thing, we're certain to discover much more oil. For another, we'll probably find more efficient ways to use it, particularly in automobiles. And other energy sources will take over some of the jobs oil now does.

What do you mean when you speak of more efficient ways to use oil?

Take the automobile engine. Today's trend is toward less efficient use of petroleum: The higher the octane rating, the less gasoline can be squeezed from each barrel of crude oil.

But there are several ways to halt or reverse the trend. For instance, fuel injection, already offered on some 1957 cars, doesn't cut the octane requirement much, but does step up both power and fuel economy. New combustion-chamber design in internal-combustion engines may permit lower octanes with no loss of power. Gas-turbine and free-piston engines can operate on many fuels, from low-octane gasoline to perhaps heavy fuel oil.

Can't our refineries be adjusted to produce more gasoline if we need it?

Within limits, yes. Crude oil is a mixture of hundreds of compounds, ranging from light ones, such as butane, through very heavy ones, such as asphalt and paraffin. Gasoline is usually made up of some of the lightest compounds; kerosene, home-heating oils and heavy fuel oils come from the heavier ones.

In the oil industry's early days, a refinery could only separate these compounds from one another by distillation. It heated the crude oil, and the lighter products boiled off at lower temperatures, the heavier products at higher temperatures.

Distillation is still the basic refining process. But modern refineries can do a lot more. They can "crack" heavier products into lighter ones. They can "re-form" lighter products into heavier ones. And

they can change the energy-producing characteristics of the products—increase octane rating, for instance—chemically.

Right now, though, we have more gasoline than we need. It's in the "middle of the barrel," the fuel oils, that we're short. This is due to the economics of the industry. Gasoline returns the highest profit per barrel. And this will be so until the scarcity of heavier fuels—and other energy sources with which they compete—forces prices up to the point where, barrel for barrel, they're more profitable than gasoline.

What about the long pull, when there won't be enough oil to supply the demand? Which products will refineries concentrate on then?

It depends on what other fuel is available. If atomic energy makes most of our electric power and runs most of our ships, there'll be less need for heavy fuel oil, and more of it can be cracked into lighter products. If some other way is found to heat our houses, then we'll need less light fuel oil, and refineries will make proportionately more of heavier products.

What about the prices of gasoline and other petroleum products?

They'll go up, of course, along with prices of everything else, if, as economists predict, inflation continues to be the long-term trend. But whether they'll go up more or less than the prices of other things depends on factors we can't even guess today—the demand for the various kinds of petroleum products, for instance, and the supply and price of competing fuels. It also depends largely on how much new crude oil is found in the future, and on how much it costs to find.

Are there any other sources of oil?

Yes, at least three: shale oil, tar sands and hydrogenation of coal. Shale oil may be commercially practical by 1960 or 1965.

Just what is shale oil?

It's a petroleum-like substance called kerogen, found so intermixed in a very fine-grained rock that ordinary oil-producing methods won't work on it. The rock itself has to be mined and crushed, and retorted to convert the kerogen into oil. Even then, it's of such low quality that it must be treated to upgrade it to the level of the usual crude oil. After that, it can go to the refinery.

TELESCOPING PLATFORM lets scalers reach rock high on walls of shale mine near Rifle, Colo.

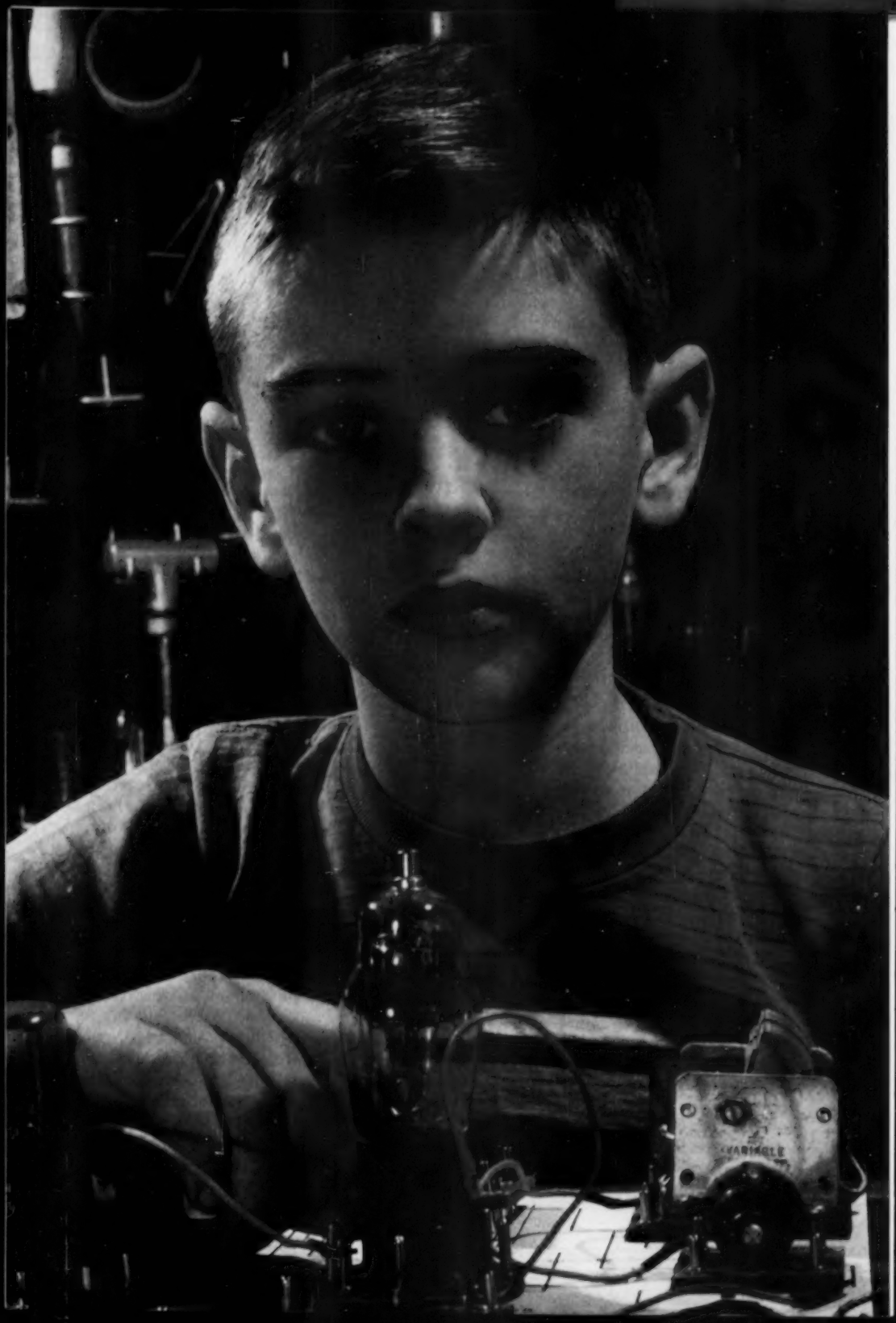
Doesn't that cost a lot?

Yes. That's the reason shale oil isn't used commercially now. But research by government and industry has brought costs down. Today, it costs only about one-third more to make gasoline from shale oil than from ordinary crude. And as the cost of processing shale oil will probably decline while the cost of finding crude will probably rise, shale oil will soon be competitive.

How much shale oil is there?

More than one trillion barrels, altogether. Most of it's in Colorado and Wyoming. But much of this is in shales having so little oil that it's uneconomical to process. There's one deposit, though, called the "Mahogany Ledge" because of its color, that contains 100 billion to 125 billion barrels, in concentrations of about 30 gallons per ton of ore.

[*Continued on page 270*]


VARIACLE

How to Be a Good Father to a Gifted Child

If yours is one of these rare youngsters, you must beware of special pitfalls that threaten your effort to help him succeed.

By John Kord Lagemann

FROM 300,000 to 600,000 American youngsters have special gifts of brain power and talent. They have the intellectual ability to become our leading scientists, educators, engineers, editors, doctors, artists, politicians, businessmen.

If you are the father of one of these wonder kids, you face a stirring challenge to help him make the most of his rare abilities. The rewards, both spiritual and practical, can be great. But there are dangers that you must realize.

Your child's superior intelligence exposes him to four main hazards: loneliness, laziness, cynicism and overprotection. Any one of them can throw his adjustment to life out of whack.

You can do a lot to spare him these handicaps.

One of the worst of them is lack of congenial friends. Loneliness breeds anxieties that can haunt him all his life. Intellectually, the gifted child is sometimes too developed to enjoy the games and share the interests of children his own age. When he skips grades in school, he has no trouble with the classroom work but he is likely to be socially and emotionally out of his depth. Though big for his age, he is small for his class. The older children often won't accept him.

Be an understanding father. With your help, he can learn how to get along with other kids despite the gap in their intellectual interests.

How can you help? Here's a suggestion

Introducing an Important Series of Articles for Parents:

Our most tragic waste of a natural resource is neglect of the potentialities of our children. The neglect is rarely deliberate. Its result, however, is a national blight, a dwindling in the ranks of scientists, engineers and members of other highly skilled professions at the very time when the U.S. needs them most—to bolster its defenses against Communism and to keep pace with the increasingly complex demands of its highly technical civilization.

Parents, because they too often fail to recognize and nourish and guide the talents of their children, are vital keys to the solution of this problem.

This article is the first of an unusual series planned by Popular Science to help parents do a better job of helping their youngsters select and train for productive, profitable and satisfying careers. Next month: "Can Your Youngster Get into College?"

PHOTO BY HUBERT LUCKETT

Is your child really gifted? Here are five clues

1. WHAT'S HIS I. Q.? Intelligence quotient is the chief clue in determining whether or not your child is gifted. It is found by the formula above. His mental age is determined by comparing his performance in intelligence tests with those of other kids. If he is eight years old, and does as well as most 12-year-olds, his mental age is 12, and his I. Q. is 150. He's considered to be a gifted child if his intelligence quotient is over 130. His school or a nearby college will test, or will advise you on tests, for your child.

2. HOW DOES YOUR YOUNGSTER USE WORDS? Most authorities believe that this is a reliable clue to his mental ability. But the fact that he learns to talk or read early is not so important a guide as his use of the language as a tool for learning. If he early asks unusually intelligent questions and seems to be truly interested in the answers, your child is probably gifted.

from Dr. Florence Brumbaugh, director of the Hunter College (N.Y.) Elementary School for Gifted Children:

"When a boy is snubbed by playmates," she says, "a father can help take the sting away by tactfully coaching his son in the sports and games that will help him be one of the gang. He can also try to steer the boy into groups where size, weight and age aren't the only criteria. Picking the right summer camp is often the solution to a bright youngster's social backwardness."

If he isn't interested in contact sports, though, don't force him. His reluctance to join in the games may be based on some as yet undetected physical flaw, such as impaired vision. On the other hand, if he is physically fit and still reacts badly to football, wrestling, boxing or basketball, encourage him to take up skiing, swimming, tennis or golf.

In many elementary schools, where special classes are not available, a gifted child is typically kept at work that is two or three grades beneath the kind of work he should be doing. Thus he wastes much of his time.

If it isn't possible to have your child

3. HOW DOES HE STACK UP PHYSICALLY? The gifted child usually weighs more than the average at birth, grows taller, stronger and healthier, is better coordinated and matures sooner than most children his age. These findings were made by Dr. Lewis M. Terman and his associates at Stanford University in an intensive, years-long study of 1,500 gifted children.

placed in a special class or school, it is up to you to provide the challenges and the disciplined work habits that he fails to get in school.

If he has a strong scientific interest or a mechanical bent that his school is incapable of fostering to an adequate degree, one possibility is to get in touch with a reputable correspondence school. You can probably enroll him in a course that will kindle his innate interest and provide just the stimulus that a bright young mind demands. Better first check your choice of a correspondence school with your youngster's school guidance counselor or principal, though, to make sure it is on the National Home Study Council's accredited list. Also, if your child is quite young, the correspondence school may ask his principal to approve his enrollment.

Don't push your child too hard. Don't overschedule his days. That can make him balky, lazy and unable to concentrate well.

"Gifted youngsters sometimes get the feeling that their parents are using them to satisfy their own ambitions," says Dr. Ruth Strang of Teacher's College, Columbia University. "When they revolt by flunking out of college or falling down on their jobs, it's really a way of saying, 'I want somebody to pay attention to *me*, not just my gifts.'"

There's a big difference, though, between pushing a bright youngster too hard and giving him challenges that keep him interested and on his toes. That's where you, especially, come in.

"Of all the things a father does for his child," Dr. Brumbaugh declares, "the most valuable is the sharing of a hobby. When we ask a gifted child how he got interested in some special field, he usually says it started when his father let him in on some interest of his or took him on an expedition or showed him how something worked."

Even as a small boy, the gifted son is apt to be bored by the usual toys. He quickly tires of running a ready-made train around a ready-made track. But he likes to take the train apart to see how it runs. He is the original do-it-yourself kid. He likes to work with real tools and build real things.

It is up to you to guide him patiently

[*Continued on page 244*]

4. MENTAL AND SOCIAL ATTITUDES? "Gifted children are less inclined to boast, are more trustworthy under temptation to cheat," Dr. Terman's celebrated survey discovered. "Their reading preferences and social attitudes are more wholesome. They score higher in emotional stability." Delinquents usually test well below I. Q. 100. It's rare to find one over 115 or 120.

5. IS YOUR CHILD GOOD AT MANY THINGS? Since intelligence enables a child to solve all kinds of problems, the individual with a high I. Q. is likely to be good at a lot of things. Intelligence helps in the understanding and appreciation of art and music. If a child has special talents in these fields, a high I. Q. will make possible a more creative use of them.

6 RULES to from

RACKETEERS WILL SWINDLE U. S. HOMEOWNERS

If you are planning to spend money for new roofing, a paint job, storm windows, driveway, furnace repairs, new plumbing, landscaping—or other home improvements—it will pay you to read this article.

By John L. Springer

AMERICANS will spend more than $15 billion on home repair and improvement in 1957, and at least $500 million of that, the Association of Better Business Bureaus estimates, will go into the pockets of home-repair racketeers.

These fast-talking gyps, known as "suede shoe" boys, are busier than ever. They have a bag of slick tricks and if you let your guard down, it's a cinch that they'll take you. I have spoken to officials of Better Business Bureaus and investigated scores of rackets. And I have found that every time a homeowner was gypped by a repair shyster, it was because he made one or more of six basic errors.

1 Don't Believe in Santa Claus

NOBODY really believes that a stranger from nowhere is going to give him something for nothing. Yet the "model house" racket is a prize example of how homeowners pay through the nose when they succumb to the urge to get something for nothing.

A salesman called upon an old lady in Phoenix, Ariz., and began talking about a new liquid that could be sprayed on her roof to make it leakproof for 20 years. "We won't charge a penny," he said. "Just give us permission to erect a sign in your yard advertising our product."

The woman gave her okay. The salesman left and two workmen began spraying the roof. An hour later the foreman rang the bell and thrust a bill for $90 into her hand.

She protested that the job was supposed to be free.

"You can't prove it," the foreman said, jabbing his finger at her. "All I know is that you owe $90. If you don't pay it now, we'll tell everybody in town and have you thrown into jail."

Terrified, the woman paid. The next day it rained, and the "miracle roof" washed off and created ugly stains all over the outside walls of the house.

In variations of this racket, a salesman promises to give you $50 or $100 for every roofing or siding job he sells in your neighborhood. Of course, you must first have a job done on your house as a sample. You're told that you'll probably collect enough in commissions to pay for it entirely. When the work is completed, you pay in full—and never see the salesman again.

Law-enforcement officers have warned against this "model house" fraud for years. Before the Federal Housing Administration underwrites home-improvement loans, it now requires both homeowner and contractor to swear that they have not made any deals involving bonuses or

Protect You Home-Repair Gyps

OUT OF HALF A BILLION DOLLARS IN 1957

commissions to be paid the owner. Yet the racket persists everywhere.

2 Don't Hunt for Spectacular Bargains

THAT same "get something for nothing" urge may lead you to try to get a lot for a little. Of course, if you shop carefully you can get lower prices, but *real* bargains—where you save half the normal price, say—are almost impossible to obtain. Here's why:

On the average, 50 percent of a legitimate home-repair bill goes for wages. Any cut has to come on materials. But prices of ordinary building materials – lumber, wallboard, roof shingles, sheathing, cement—never drop sharply enough to permit dazzling bargains. Moreover, there's no annual change in models—such as occurs with appliances—that might enable you to pick up a discontinued unit at 30 or 40 percent off.

So hang onto your wallet when contractors promise fabulous savings, and watch out for "bait ads" that quote ridiculously low prices.

Storm-window salesmen—long a thorn in the sides of officials of Better Business Bureaus everywhere—use "bait" ads with unbelievable success. The best brands of windows cost from $20 to $30 apiece. Almost everywhere, you'll see windows advertised for less than $10—sometimes even as low as $6. But call the salesman and try to buy them. He will spend hours, if necessary, discussing more expensive windows. Or if you insist upon the lower-priced windows, he'll write a contract and take your deposit. You may wait months for delivery—and the contract states that you can't do anything about it!

Do you need new siding on your house? According to a common type of ad, you can get the job for $300 or $350. But if you squint your eyes and read tiny type you'll discover that the advertiser is talking about an "average home 24 by 20"—which is actually about the size of a respectable chicken coop. Odds are, a siding job for your house will run double or triple the "bait" ad price.

"Price is always important, but there are other factors to consider," the Cleveland Better Business Bureau warns. "The reputation of your contractor or of products you buy means a lot—including the greatest value for your money in the long run."

3 Be Cautious with Doorbell Salesmen

MANY reputable firms sell merchandise and services from house to house, but the percentage of legitimate doorbell canvassers in the home-repair field is low.

I have examined hundreds of complaints made by chiseled customers to the Better Business Bureau. In at least three out of five cases, the fraud started with a fast-talking "suede shoe" character at the front door.

The door-to-door salesman is a key man in the "miracle paint" racket. He'll promise to paint your siding with a new concoction supposed to last 20 years. Buyers

may end up paying five times more than an ordinary painting job costs, and be lucky if the paint lasts a year.

A large percentage of frauds involving landscaping and tree maintenance also start at the front door. Some gyps claim that they can feed your lawn with a fertilizer that turns hard clay into rich, loamy topsoil. The fertilizer turns out to be crushed hay, outrageously overpriced.

Victor H. Nyborg, president of the Association of Better Business Bureaus, says that the door-to-door approach is favored by two types of operators who cause homeowners a great deal of grief. These are the itinerant contractors and the bonus or cost-plus operators.

The itinerants float from city to city, using a truck without identification. They pick up jobs here and there and leave a trail of unfinished or shoddy work.

"Bonus boys" are salesmen who sell jobs for home improvements and then arrange with contractors to do the work. They sell the homeowner for all the traffic will bear, skim off the profits, pay the contractor and move on, leaving the actual workman and homeowner to battle the job out. Deal with a "bonus boy" and you may pay $1,500 for work that the contractor actually does for $500.

4 Don't Fall for "Government Inspectors"

MANY gyps claim that they work for the local government. To gain access to your home, they may pretend to inspect your plumbing, home appliances or other equipment. Before you know it, they try to sell you an expensive repair job.

Thousands of homeowners have been taken in by "furnace inspectors." These men announce that they've been sent to check your heating equipment "for your safety." If they can, they'll dismantle your furnace and force you to sign for an expensive and unneeded repair job before it can be put back into operation again.

In Oakland, Calif., a "safety inspector" got into a home by promising to give an

Before you touch pen to contract on any costly home-repair job, you should ask yourself these 15 money-saving questions:

► Do you know the name of the salesman and the name and address of his company?

► Do you know, or have you investigated to determine, before signing the contract, that the company is of good reputation, dependable, responsible? Or have you asked the salesman or company for references?

► If any guarantee is given, is it in writing in the contract, clear and specific as to what it means and as to what will be done in the event of trouble?

► If the company is making a long-term guarantee, do you have good reason to believe that it will be in existence and financially able to fulfill the guarantee 10 or 20 years later?

► Have you obtained more than one bid on the same job on exactly the same specifications?

► Does the company provide liability and compensation insurance to protect you in the event of accident?

► Do you know by what bank or financing agency your contract or note would be financed? Or, before signing a contract, have you consulted your own bank or financing agency about financing this job?

► If work is to be subcontracted, will you be protected against liens on your home?

► Does the contract contain the name and address of the company; specifications such as type and extent of work; when to be done or completed; areas; extras; description of materials such as quality, grade or name, weight, color, style, etc.; total cost, finance charges, etc?

► Is the contract completely filled in, have you read it and do you understand it completely before signing, and are you to be given a complete, readable copy signed by the salesman of the company?

► Does the salesman try to "high-pressure" you into signing a contract?

► Has the company or salesman represented that your home would be used for advertising purposes, as a model job, or show-house, or by display of their sign, and that for this you would be given a special price?

► Has it been represented that F.H.A. has anything to do with performance of the company or guarantee of the job, other than merely insuring the loan granted by your bank?

► Are you asked to pay in advance, or to pay cash to a salesman instead of by check or money order to the company itself?

► Are you asked to sign a completion certificate for the job by appeal, threat or trick before the job is properly completed?

Your answers to the last five questions should be "no," to all others "yes." If you have the wrong answer on any of these, you are leaving yourself open to possible loss.

**These questions, prepared by the Association of Better Business Bureaus, represent the commonest reasons why homeowners are defrauded.*

"educational talk" on fire prevention. Soon he was in the middle of a sales pitch for a home fire-alarm system costing $300. He told a gruesome story of how the children might be burned to death because their parents wouldn't protect them properly. The father was shamed into signing up for a system that could have been installed for $30.

Warns the Better Business Bureau of Detroit: "Remember that inspectors or other employees of governmental agencies must display credentials on request, will not try to sell you anything, and cannot recommend any particular company or product."

5 Never Act on Impulse

FAST-TALKING sharpers invariably try to get you to act before you can think. If you took time to reason things out, you would probably spot their hidden gimmicks.

Recently, a repairman knocked on the door of a house near Boston. When the housewife answered, he began a breathless tale about the dangerous condition of her chimney. In a few minutes he convinced her that it might collapse any instant, killing a few children. He could repair it and make it as good as new—for $100.

The woman hesitated. "I'd better talk it over with my husband," she said. "Lady, this job can't wait," the repairman said vehemently. "Would you endanger the life of a child for a measly $100?"

Frightened, the woman told him to do the job. He mixed a batch of cement, climbed a ladder, and began slapping mortar on the joints. After an hour or so he was down to collect.

The work was worth less than $10. Moreover, it could have waited months before becoming really necessary. Given a few calm moments, the woman would have thought it a strange coincidence that the repairman arrived in the nick of time to save the chimney from collapsing. By getting her to act before she could reason,

the roving gyp pocketed an unearned $90.

Houses don't deteriorate overnight. Usually no great harm is done by waiting long enough to get several bids and investigate contractors. "For every person who may have suffered a loss by waiting a few days to sign a contract for home repairs, probably a thousand have lost money by acting too quickly on impulse," officials of the Better Business Bureau told me.

6 Read All Contracts!

MOST home-maintenance shysters offer you contracts that are hard to read and understand. A good contract should clearly show:

- What work is to be done.
- When it is to be completed.
- Exactly what materials are to be used.
- The total price, including any interest or carrying charges.

If the salesman makes any promises, you'd better get them in writing, or you may not be able to hold him to them.

In New Orleans, one homeowner signed a $2,000 contract for extensive repairs to an outside wall. The contractor put new sills under the back of the house, replaced the studs, and began to use rotted boards as sheathing. When the owner protested, the contractor pointed to the contract. "Nothing says I promised to supply *new* sheathing," he said. The owner was stuck.

Another contractor in that city agreed to install concrete strips for a driveway. The strips went in, as per contract, but they were so far apart that no car could straddle them. Under the contract, the homeowner was helpless.

It's also important to know when you're making a contract. "Sometimes buyers make contracts without realizing it, or don't protect themselves with a contract when they should," says Jack Johnston of the Better Business Bureau of Chicago.

Generally, you are making a legal contract any time you sign an agreement to pay for work done. One man in Indianapolis ordered a porch built, and signed a simple paragraph agreeing to pay $600. Then he discovered that the contractor had a list of dissatisfied customers that could fill a book. He tried to cancel the job, but the contractor sued and won. The court ruled that agreements need not be labeled as contracts to be valid.

Not long ago, I sat in different offices of the BBB and observed staff members interviewing persons whose signatures had got them into trouble. Here are some "famous last words" I heard:

"I signed a contract on Sunday, thinking it was not binding." (A woman said that a storm-window salesman called on her and talked for two hours. "I signed to get rid of him to go to church. I don't want the windows." But she had to take them—and pay.)

"I signed a contract with a guarantee. Now I want my money back." (A "guarantee" means nothing unless the contract tells exactly what is guaranteed—and what recourse the buyer has. Some so-called guarantees are full of loopholes.)

"I never got a copy of the contract I signed." (Buyers are entitled to one.)

"I didn't read what I signed; therefore the contract is not valid." (A common fallacy. When you sign your name, you're supposed to know what you're doing.)

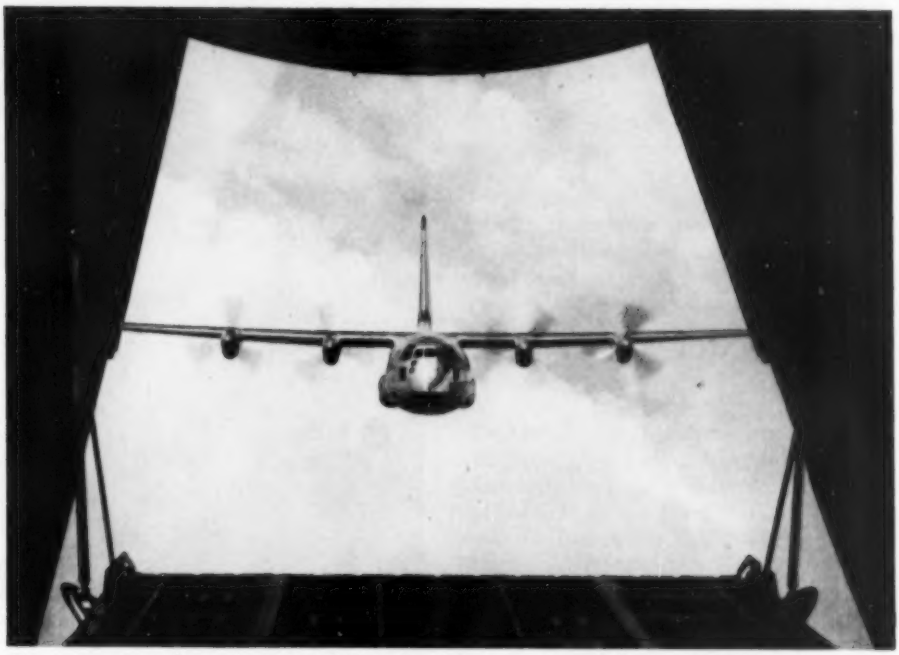
"I signed a blank contract and the seller filled in the terms." (This happens shockingly often. If you can *prove* fraud, you may sue and get your money back. But it's a long, nerve-wracking process.)

"The salesman told me I could cancel my order within a week, so I signed. Now I can't get my deposit back." (Many contracts read, "No verbal representations are recognized." That means the buyer must get everything in writing.)

Contract or not, the best way to insure satisfaction is to deal with people or concerns you know are trustworthy. Established stores and craftsmen often bend over backwards to satisfy even customers who are plainly wrong.

If your agreement involves a large sum of money, always consult a competent attorney *before* signing. END

Air Force Gets a Fast New Cargo Plane . . .

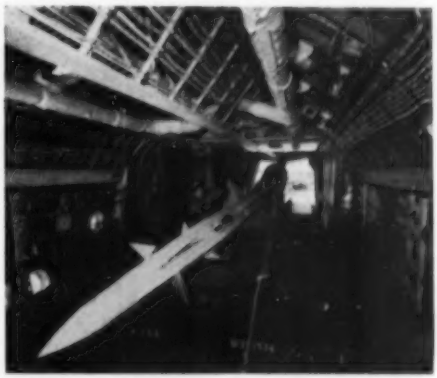


Open rear cargo door of one C-130 Hercules frames another of the new turboprop transports.

A NEW 370-m.p.h. workhorse has joined our Tactical Air Force. It is the C-130 Hercules, a four-engine turboprop combat transport that can take off or land in less than 1,000 feet.

In 20 minutes' ground time the 62-ton Lockheed plane can be changed over to do many different jobs:

- Haul 20 tons of cargo.
- Parachute-drop single loads weighing up to 25,000 pounds.
- Carry 74 litter patients and two medical attendants in hospital comfort.
- Fly 92 fully equipped infantrymen.
- Dump 64 combat paratroopers from side doors or out a rear ramp opening.



A NIKE MISSILE FITS EASILY into compartment that is readily convertible to haul personnel.

. . . and plans one 4 times bigger

World's Largest Plane Will Carry

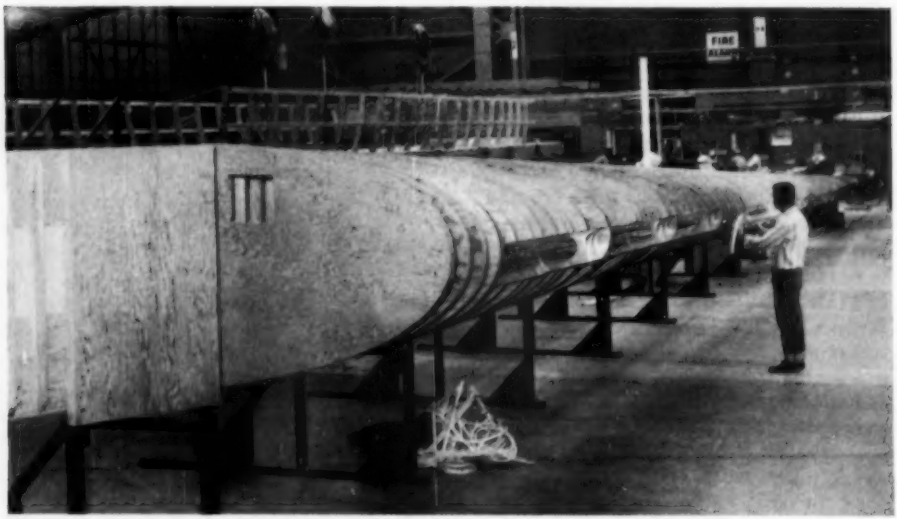
A WINGED leviathan able to lift a half-million pounds—itself and a 100-ton payload—off a runway is now being developed. It will be the biggest man-made bird yet.

With a 50-ton half load of military supplies, the C-132 will range 3,500 miles at 460 m.p.h., says the Air Force, revealing first details on its "logistic air transport of unprecedented dimensions and cargo capacity."

The speedy giant is now in the mock-up stage of development at the Tulsa, Okla., plant of the Douglas Aircraft Co., where these exclusive photos were taken. *Each* of its four turboprop engines will develop 15,000 hp.—more than the total power of *all four* engines of a Super Constellation airliner. The 200,000 pounds of payload the C-132 will haul would be equivalent to 1,000 fully equipped combat troops, if they could be squeezed into the cargo compartment.

The 250-ton gross maximum takeoff weight of the C-132 is almost four times that of a DC-7 commercial airliner, or twice that of the new, not yet operational C-133 military transport.

One sky giant like the C-132 shown in mock-up



Span of wing has not been announced, but it is a long walk for this worker from tip to root.

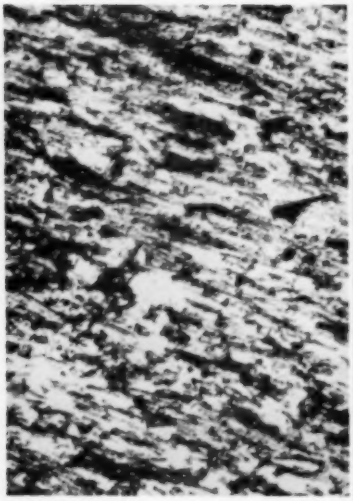
50 Tons to Europe Overnight

means less maintenance, fewer crews, simpler ground facilities than for several smaller planes.

NO EMPTY SHELL, this C-132 mock-up is fitted out with actual cockpit instruments. Here part of the complex electrical system that will operate the fire-warning units is being tested.

MAIN LANDING GEAR has 16 huge wheels, with two four-wheel units in tandem on each side. The arrangement spreads weight and will permit C-132 to operate from normal runways. END

Iron



IRON DUST, shown magnified 20,000 times by electron microscope, makes superpowerful permanent magnets. Elongated particles, whose shape is key feature, are aligned in plastic or other binder.

TINY IRON PARTICLES are made by GE by electroplating them from solution of iron compound into tank of liquid metal, such as mercury, which forms cathode. They float to surface and can be gathered by hand with a magnet (left).

FEATHERY particles of iron, too small to be seen with ordinary microscopes, promise the most powerful permanent magnets ever made.

Embedded in plastic, metal, glass or rubber, the specially prepared iron dust yields magnets that are easily fashioned into any desired shape.

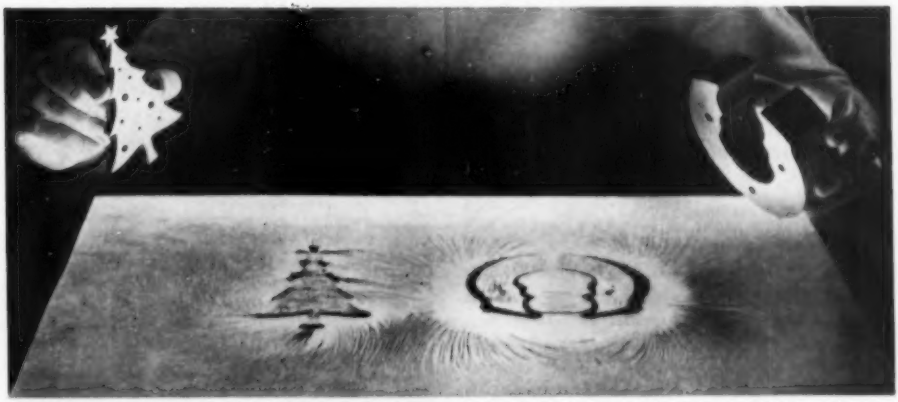
Announcing this new way to make magnets, the General Electric Company calls it a major scientific breakthrough.

Smaller, lighter, more accurate and rugged electric devices will result—exposure meters, aircraft instruments, countless other magnet-using articles.

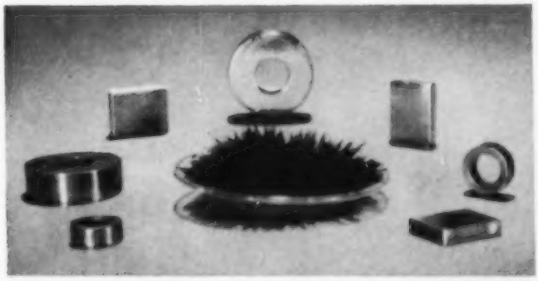
It will be some time before the iron-dust magnets are commercially available in quantity. But experimental ones have proved as powerful, in proportion to size, as today's best commercial magnets. "And we believe," says GE, "that we can make them 10 times stronger."

More has been learned about magnets' basic structure in the last 10 years than in the previous 20 centuries, GE notes. In our schooldays, we were taught that ordinary soft iron was fine for electromagnets, but no good for permanent magnets—since, as everyone knew, a solid chunk of iron wouldn't stay mag-

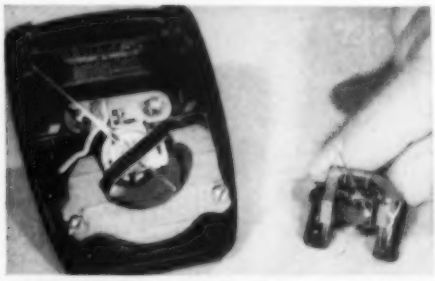
Dust Makes Supermagnets



ORNAMENTAL MAGNET (left), of iron dust embedded in lead, contrasts with conventional one (right) and offers example of novel shapes and materials now possible. Patterns below, formed by common iron filings on sheet placed over these magnets, compare their magnetic fields.



NEW MAGNETS of varied design surround plateful of iron-dust material. It looks black because of particles' fineness. A pound contains more than a billion billion of them.



EXPOSURE METERS vividly show new magnets' space-saving possibilities. At left is conventional meter; at right, midget experimental one (not on market) with an iron-dust magnet.

netized. So old-fashioned "horseshoe" permanent magnets were of tungsten or chromium steel; more modern ones, of Alnico, an aluminum-nickel-copper alloy.

"Fine-particle" permanent magnets are the latest advance. By using a magnetic material in small particles, rather than in solid form, they have upset former rules and turned some of the least likely materials into the best. Powerful enough to rate as "supermagnets" are three principal kinds:

Westinghouse has recently announced supermagnets of manganese bismuth, a powdered compound of these two metals, embedded in plastic (PS, Sept. '56).

Barium ferrite, a readily molded ceramic composition of barium and iron oxides, has been developed abroad and introduced here for supermagnets.

Now come the supermagnets of pure-iron particles. According to theory, GE maintains, their maximum possible strength far outranks that of the others. And it can be boosted even a little further, GE scientists say, by using an iron-and-cobalt combination of particles. However, the iron-only magnets have the big advantage of requiring no strategic materials.—*Alden P. Armagnac.*

What's All This Fuss

If you've been puzzled by the lingo, awed by the crowds at the

EDITOR'S NOTE: For the past several months, POPULAR SCIENCE *has featured in each issue an article about one of the various components that make up a high-fidelity sound system. We have covered turntables (Oct. '56), pickups (Nov. '56), tone arms (Dec. '56), amplifiers (Jan. '57), speakers (Feb. '57) and our own PS Test Record (Jan. '57)—which enables you to evaluate your equipment. An article on page 196 of this issue tells you how to use the test record to tune your speaker cabinet.*

These articles were intended mainly to provide expert, professional advice for technically minded audiophiles. So many readers asked us for a more general explanation of the subject, however, that we present the following article for all music lovers who have thought of adding hi-fi equipment to their homes.

JUST eight years ago the high-fidelity "industry" was a curiosity. It consisted of about 30 little manufacturers who worked in garages and lofts to make mad-scientist-looking stuff which they sold to a few thousand people called "audiophiles." The audiophiles assembled the stuff into absolutely spectacular phonograph rigs, which they put to the most peculiar uses. For example, they liked to turn the volume up full and flood the neighborhood with a magnificent rendition of a summer thunderstorm. Except for the neighbors, however, no one paid much attention. In those days high fidelity was such a rarity that if you heard a man complaining about "flutter and wow," you just thought he had a nervous condition.

Today, the 30 manufacturers in garages have become about 150 manufacturers in bustling little factories. The coterie of fans has spread to every city in the nation: In New York alone, the last hi-fi show burst the seams of the Trade Show Building with 30,000 paying customers. Almost overnight, high fidelity has become the biggest new popular hobby since the invention of photography. Its appeal lies in its amazing ability to create the illusion that the music you hear on a

HAPPY HANGOUT FOR HI-FI FANS: A typical scene at Harvey's on New York's Sixth Avenue.

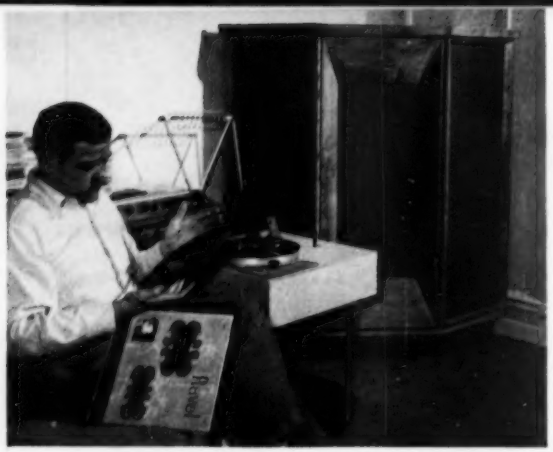
About Hi-Fi? By Robert L. Heilbroner

dealer's, and defensive about your old Victrola, here's the lowdown.

record or a radio is being performed "live" right in your room. The hi-fi word for it is *presence*.

"When I listen to Mozart on my rig," says one enthusiast, "it's like being in the concert hall. There isn't any machinery to get between the music and me."

There is, of course, a great deal of machinery in hi-fi, and an even greater deal of mystification about just what it does. Actually, a hi-fi rig, like any ordinary radio-phonograph, has four ma-



THE TRUE AUDIOPHILE—in this case, James Lyons, associate editor of the *American Record Guide*—is mighty fussy about the quality of his hi-fi components, not about their looks.

jor components: a record player, which is the part with the pickup arm and needle; an amplifier, which is the box with the knobs outside and the electronic business inside; a loudspeaker; and, for the audiophile who wants glorified radio reception, a tuner. What differentiates hi-fi from non-hi-fi is what distinguishes a custom-built yacht from a rowboat. In a high-fidelity set each component is a superbly precise instrument in its own right. Hence most hi-fi fans spend long hours agonizing over the choice of record player "A" versus turntable "B," debate whether this should be combined with amplifier "X" or "Y," and will probably go to their graves still undecided as to which is *exactly* the right loudspeaker.

ONE all-out high-fidelity man began some years ago with a rig using a single speaker. It wasn't quite good enough on the low tones, so he added a special "woofer," or low-register speaker. That left the high tones lacking, so he put in a tweeter to take care of the high sounds. That still wasn't *quite* fi enough, so he put in an extra middle-range "squawker." That wasn't *quite* good enough for—well, he now has 22 speakers, and he isn't *quite* satisfied yet.

For such audiophiles, the sheer technical brilliance of hi-fi can become a delightful end in itself. In fact, true addicts buy special records such as Emory Cook's "Rail Dynamics," an ear-splitting recording of the screech, clatter and blast of passing trains, which, when played on a properly sensitive rig, does everything but throw cinders in your face. Or they will play records with tones so low you can't hear them—you have to *feel* them in your stomach. And sheer perfection is reached when the hi-fi bug turns up his controls full and puts on the supreme test record—a disc with unrecorded grooves. Listening in rapt attention for the least sign of motor rumble or undesired hum, he has achieved the dream of dreams—a flawless machine that will play in complete silence!

These agonies and antics can perhaps be better understood if we stop to appreciate the fantastic job that a phonograph—any phonograph—is supposed to do. Take a violinist playing a single note: From the audio engineer's point of view, the fiddler is merely making the air vibrate. If he plays a high note, the air molecules do a jig; if he plays a low note, they perform a stately gavotte. For each note there is a vibration rate, which the sound engineer calls a "frequency": The bottom note on a piano, for instance, has a frequency of 27.5 cycles (to-and-fro movements) per second, whereas the top note on the keyboard has a frequency of 4,186 cycles per second.

But if music were only a matter of frequencies, we couldn't tell one instrument from another, for the frequency of middle C is the same whether it is scraped on a string, blown through a horn or produced by the human throat. What enables us to distinguish among instruments is that each one also causes the air to vibrate in additional patterns, called overtones. These are as individual for each instrument as fingerprints.

Now multiply the enormously complicated sound pattern of one violin by 20 other violins. Add the special vibrations of the cellos and the contrabasses. Put in the funeral-march frequencies of the timpani and the St. Vitus dance of flutes and piccolos, and you have an idea

of the commotion in the air of Carnegie Hall when a symphony orchestra attacks a score. What the sound engineer has to do is "translate" this Niagara of air vibrations into wiggles in the groove of a phonograph record, using the most sensitive microphones, electrical equipment and precise cutting styluses.

WHEN we lower the phonograph needle onto a long-playing record, we force its tiny point to racket along a track 2½ thousandths of an inch wide, where it gets buffeted back and forth by the turns and twists of the trail like a miniature bobsled. The vibrations travel up the needle into a device that generates a minute electrical current. We soup up the current several thousand times by means of an amplifier, presumably without adding or subtracting an iota from its original pattern. The fortified current goes into a loudspeaker and through a coil, which gets pushed and pulled by a magnet. The coil, which is hitched to the loudspeaker cone, shakes that cone back and forth much as one might shake a blanket. In turn the cone batters the air molecules and presto!—the result is supposed to be exactly the same complex pattern of vibrations that perturbed the air in Carnegie Hall. That's all there is to it.

WHAT does high fidelity do that an ordinary phonograph doesn't? Actually it does nothing very *differently*. It just does everything so much better that the result of switching from low- to hi-fi is like taking off earmuffs. For high-fidelity recording today packs a good deal more into the wiggles than used to be there, and even a "low-fidelity" recording asks more of an ordinary phonograph than it can do. The very low frequencies of the bass instruments won't work up enough energy on an ordinary machine to make the speaker vibrate the air, while up at the other end of the sound spectrum the twitterings of the high strings produce such high frequencies that a run-of-the-mill amplifier or speaker simply can't cope with them faithfully. Add to this the "wow" or "flutter" produced

A NEWCOMER TO HI-FI may prefer to embark upon the hobby with a rig that looks elegant as well as sounding nice. The industry is now changing its style to cater to this trend.

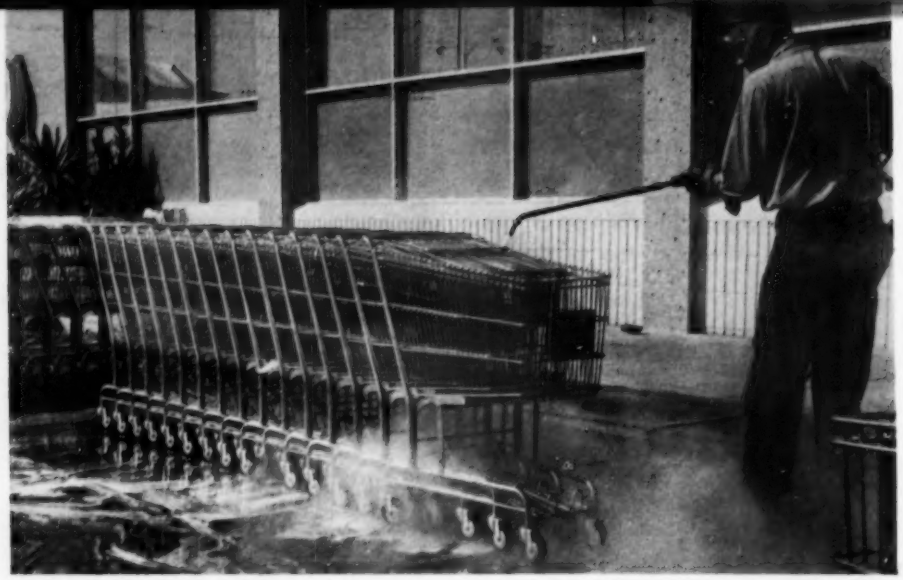
by turntables that wobble ever so slightly, the buzz of amplifiers and loudspeakers, and you can see why a hi-fi buff speaks of low-fi in tones mingling pity with horror.

Turn it around, and you can see too why someone who has never heard hi-fi before often can't believe his ears. One man, hearing Haydn's "Military Symphony" in a hi-fi salon for the first time, refused to believe he had the same record at home. He had simply never heard all the instruments before.

High fidelity goes after interferences with exquisitely precise engineering. If a turntable, for example, is as much as a hundredth of an inch off true, or if the motor is a split heartbeat off even, "wow and flutter" rear their ugly heads. Hence a hi-fi turntable maker machines and rejects, machines and rejects until he has a table accurate to within less than one-thousandth of an inch.

THE same perfection characterizes each part of a first-rate hi-fi rig. A pickup, for example: the part that holds the needle. A low-fi pickup makes the needle act like a blunt club that stumbles down the record groove. A hi-fi pickup (often a magnetic type), using a diamond needle to resist wear, is featherlight and so sensitive that it responds to

[*Continued on page 250*]



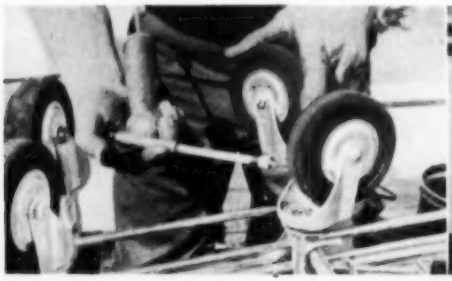
A STERILIZING BATH in detergent-laden steam is the first thing that the cart doctors order. Technibilt trucks carry equipment behind their cabs for superheating and pumping water.

They Doctor Ailing Grocery Carts

THAT almost universal American vehicle, the supermarket cart, may appear to be indestructible, but it develops ailments just like the family car.

Its wheels get scuffed flat, or jammed with dirt-caked grease. Its frame accumulates drizzles of syrups and juices and milk, which soon generate acids that eat away the chrome finish. Its nose bar gets broken and its seat gate crumpled, mostly when heedless grocery boys try to nest and push too many carts at a time. Its wire basket gets dented in collisions with heavily loaded stock carts. Sometimes, after being emptied outside a market, it is abandoned to be bunted about or forced out of shape between a backing car and a wall or parking-lot divider.

Doctors for ailing carts throughout the Southwest are the Technibilt Corp., Glendale, Calif., which treats 30,000 of of them a month. Technibilt keeps on the road a fleet of nine servicing trucks, manned by factory-trained mechanics, which roll up beside supermarkets and periodically put carts through a revitalizing routine that is shown in the accompanying photos.



SWIVELS ARE LUBRICATED after steam-cleaning has removed the dust, string and sawdust that accumulate there, often in a goop so thick that it completely stops the swivels from moving.

STRAIGHTENING OUT DENTS is done with rubber mallets. Carts with broken bars or wire mesh are taken back to the Technibilt factory for rewelding unless the part needs replacement.

Now They Drop Bombs UP

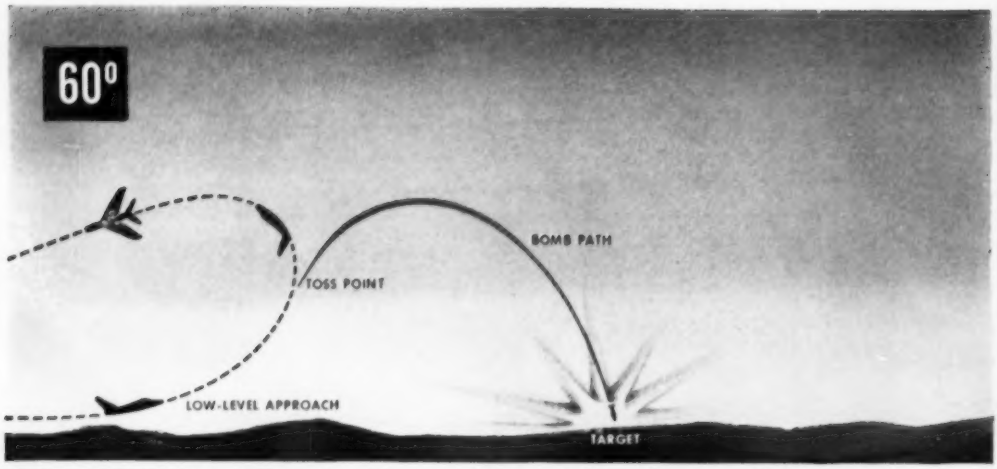
An acrobatic technique that nearly made the screwball bin gives a pilot time to escape from his own deadly blast.

LOW-ALTITUDE attack with an A-bomb can be suicide. Even small nuclear weapons have big blasts, enough to blow a fighter-bomber pilot and his plane out of the sky if he's too close to the target when his egg hits.

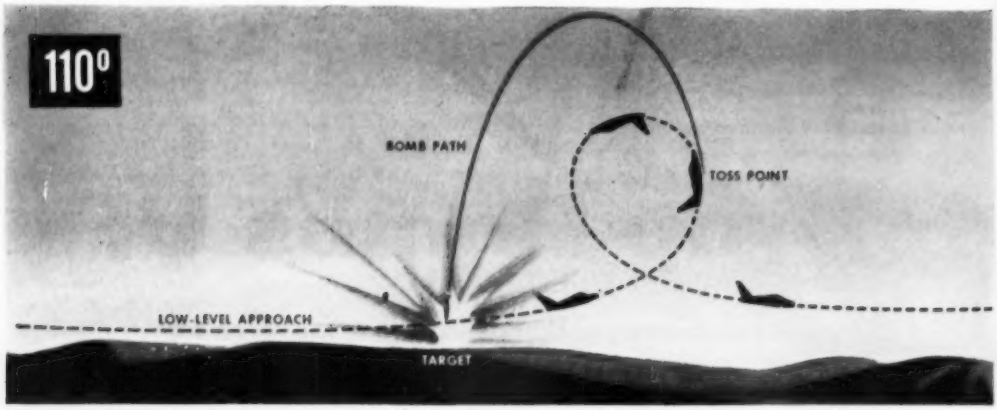
Bomb-carrying fighters, nevertheless, must be able to come in low—right over the treetops if necessary. For one thing, they do not carry the complex aiming systems that make it unnecessary for the high-flying big bombers even to see their targets. A fighter pilot must positively identify his target. In dive bombing, a pilot would have to pull out at a very high altitude to escape a nuclear blast; this would make target identification difficult on a clear day, and impossible in bad weather.

That was the problem that had the Air Force tactical experts stymied a few years ago. They asked for suggestions. They got them—by the hundreds: parachute bombs, glider bombs, guided bombs, and one that bombs be towed at a several-miles safe distance behind the plane.

Then came L.A.B.S. More than a suggestion, it was a complete *L*ow *A*ltitude *B*ombing *S*ystem that had been developed in six weeks of spare time by Joseph A. Ryan, a lieutenant colonel who had flown many low-altitude missions as a P-47 fighter pilot in Europe during World



SEVERAL MILES SHORT OF TARGET, the pilot can toss his bomb up at a 60-degree angle and be as much as eight miles away when it bursts. This 60-degree technique, however, calls for a ground identification point at which the system's preset maneuver goes into operation.



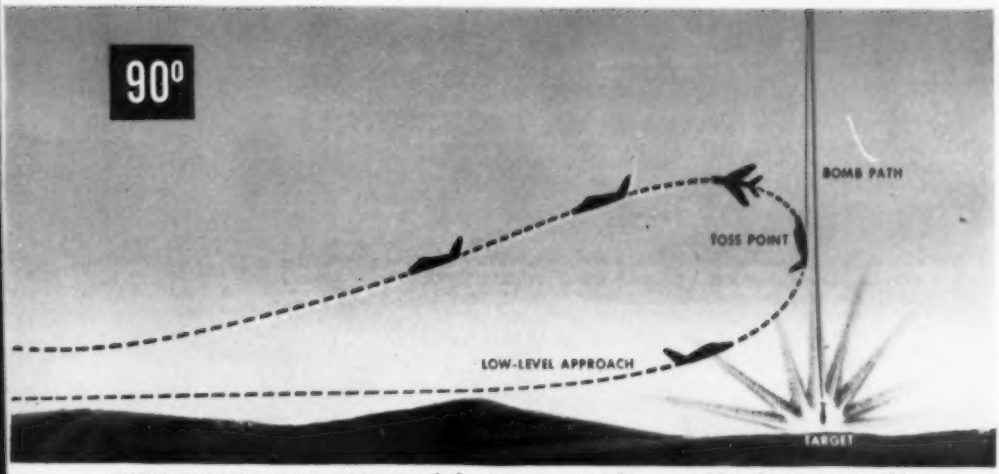
OVER THE TARGET AND AWAY FAST to on-the-deck escape is illustrated here in the 110-degree tossing technique. Target identification is positive and bombing accuracy high. During its high-speed evasive maneuver the plane is a difficult target for enemy ground fire.

War II. At first glance the device looked so simple that it was in danger of being put in the "screwball" bin.

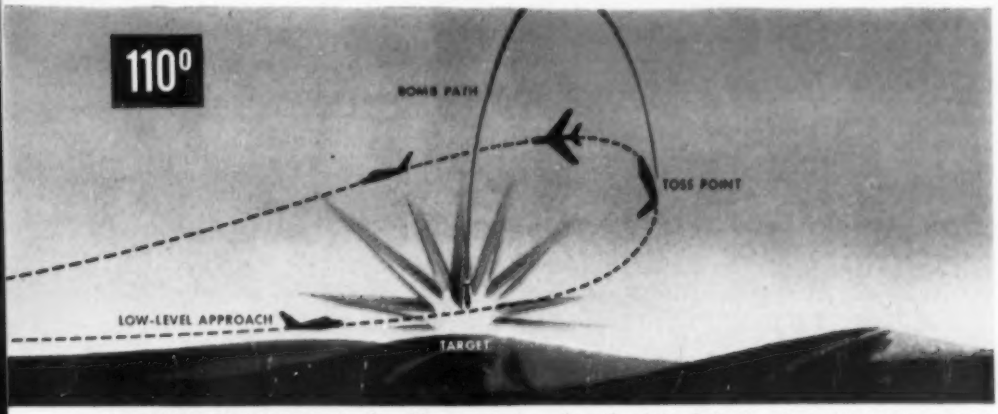
A good look at Col. Ryan's calculations, wiring diagrams and cardboard models, however, quickly convinced the powers-that-be. Permission was granted to use the Air Force engineering and electronic shops at Wright Field to turn out a prototype. Today the 39-year-old senior pilot and aeronautical engineer is busy with other things, but his L.A.B.S. brainchild, for which he received the Legion of Merit, is operational with the Air Force throughout the world.

L.A.B.S. is simple, certainly so far as the pilot is concerned. Whatever black magic it performs goes on in a "little black box" whose working are a well-kept secret. It has a computer, Col. Ryan admits. Ask him what kind of a computer, or how it works, and he smiles and changes the subject.

Range is presumably the most impor-



POSITIVE VISUAL IDENTIFICATION of the target may be necessary. A 90-degree tossing, as above, lets the pilot get close, then throws the bomb straight up, enabling him to go into his turn and put three to four miles of safety behind him. Accuracy is greater than 60-degree tossing.

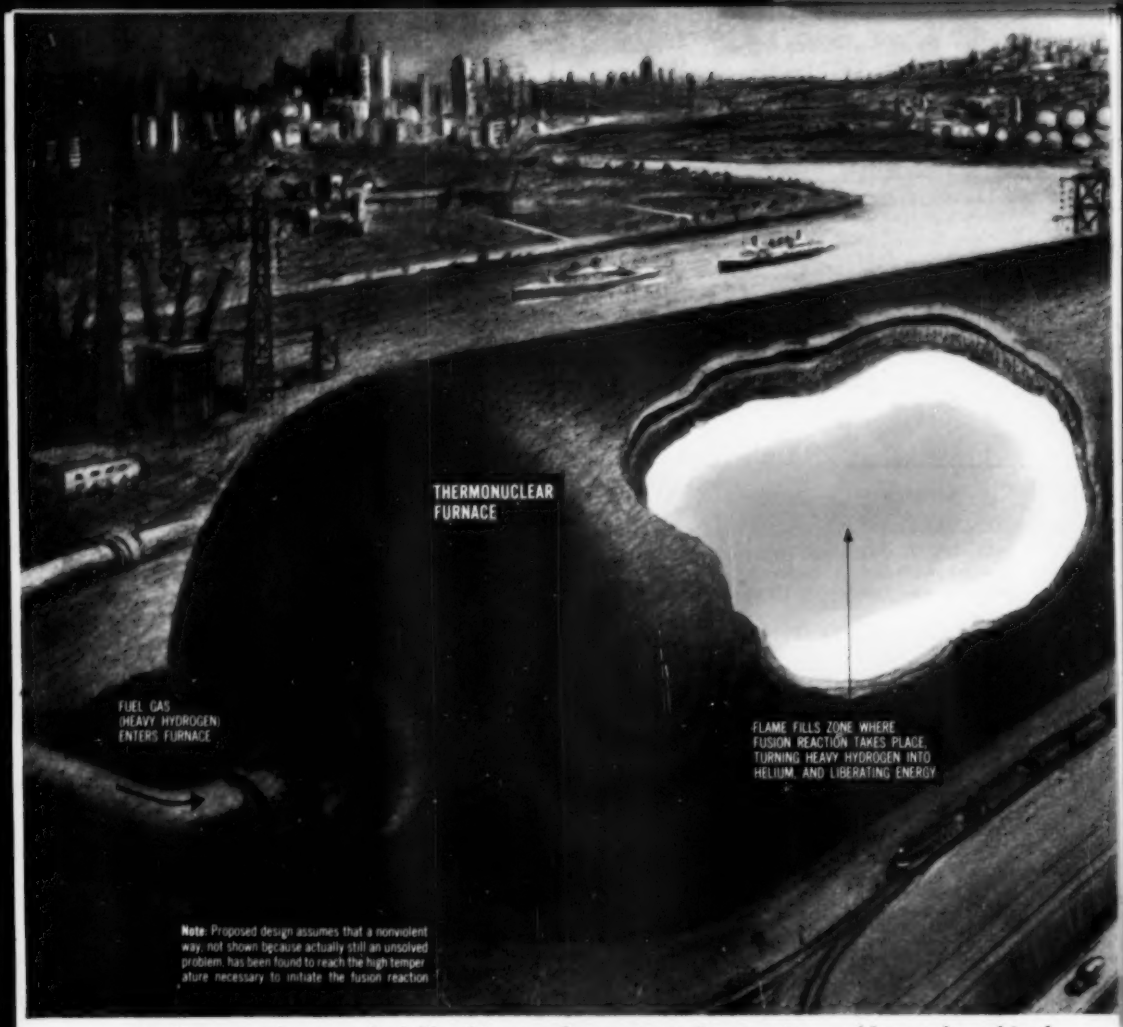


A CHANGED SITUATION: As the pilot comes in for a 110-degree toss bombing, he sees that his intended route of escape beyond the target is heavily defended. He alters his tactics, tosses the bomb, turns over on his back and scoots back in the direction from which he came in.

tant piece of information that has to be fed into the computer. This can be preset before takeoff or put in by the pilot during flight, as would be necessary on target-of-opportunity missions. From then on everything is automatic. As the pilot comes in over enemy territory on the deck, he watches a light in his gun sight. When it goes out, he pulls up in a steep climb, at top speed, flying on instruments. At exactly the right altitude, the mechanism tosses his bomb load away and up at an angle that will take it on a trajectory terminating at the target.

Meanwhile the pilot completes a tight loop or other escape maneuver and speeds away, hitting the treetops again to evade enemy fire. The relatively leisurely trajectory of the bomb gives him ample time to put several miles between himself and the nuclear burst.

Pilots like L.A.B.S. for another reason. It's an excuse for acrobatics at low altitude.—*Herbert O. Johansen.*



An H-power plant may look like this, one plan suggests. Its capacity would exceed combined

Will This Furnace Yield

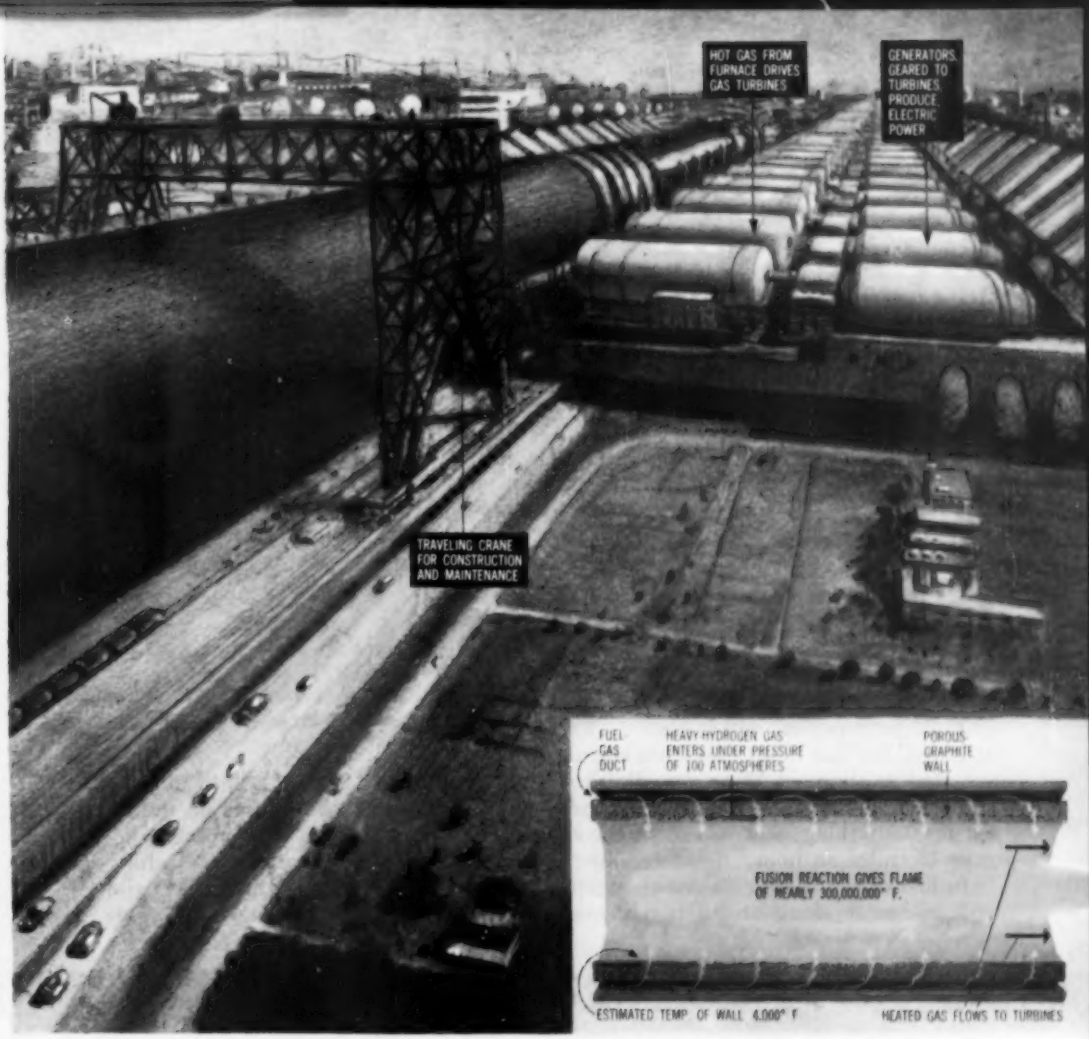
HYDROGEN from the sea will furnish us safe and unlimited nuclear power, when we learn to harness the H-bomb's fusion reaction. First, a way must be found to kindle it, less violently than with an A-bomb.

Then comes the problem: What firebox could withstand the sun-hot flame? One possible answer, pictured here, is offered by Dr. Hsue-shen Tsien, former Caltech professor of jet propulsion.

A giant cylinder of graphite forms a heat-resisting "fusion furnace." Pumped through the porous wall, heavy-hydrogen gas cools it, and fuels the flame within. Hot gas from the furnace drives gas turbines coupled to electric generators.

Unburned fuel in the turbines' exhaust gas is purified of "combustion" products—helium and tritium—and pumped back to the furnace, along with fresh fuel to replace what has burned.

The furnace must be at least 325 feet in diameter and 3,250 feet long, by Dr.



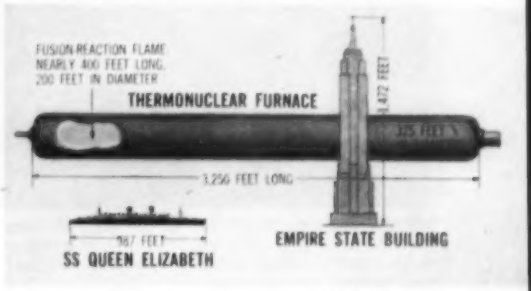
output of all power stations in U. S. today.

SECTIONAL VIEW **of H-power furnace (inset above) shows scheme to enable it to withstand flame temperature of millions of degrees. Incoming fuel gas would cool porous-graphite walls and keep flame away from them, by interposing a zone too cool to support H-reaction. Furnace's giant dimensions are compared below with size of world's largest liner and tallest building.**

H-Power?

Tsien's figuring. One such plant would produce 300,000,000 kilowatts, more than all U. S. generating capacity today.

Some scientific critics doubt whether gas cooling will suffice to keep Dr. Tsien's furnace from going up in smoke. For many hold that the thermonuclear flame will vaporize any known material, and so can be confined only by an electrical or magnetic field. But most are optimistic that, eventually, all H-power problems will somehow be solved.



The Truck That Can Do Practically Everything

By Herbert O. Johansen

Downstream goes Unimog, heading

ONE of the world's fastest cars—Mercedes-Benz—now has a stablemate that may be the world's *slowest* modern vehicle. Its name? Unimog. It's an ugly little brute, it boasts only 30 horsepower, and it costs $4,400 stripped. But this blunt-nosed workhorse can do just about anything you ask it to, from digging postholes to fighting forest fires—anything, that is, except travel over 35 miles an hour.

In first crawling gear its diesel engine will nudge it along at 0.2 m.p.h. and hit a top speed of 0.7. Shift to sixth gear, and the vehicle will get up to that 35 miles on a smooth, level road.

Is it a car, a tractor or a small utility truck? The Daimler-Benz people, who make the Unimog at Gaggenau, Ger-

ROUGH RIDING: That's me at the left, holding on for dear life. No road this, but a steep wilderness clearing, strewn with boulders and tree stumps, for a Quehanna power line.

UNIMOG'S WINCH, coupled to a four-legged metal rig, went to work at a nearby farmhouse. It pulled an old electric-light pole straight up out of the ground as if it were a toothpick.

for the Susquehanna. With no ignition in its diesel engine to get wet, water spray is no worry.

many, call it an implement. Hence its name: *Uni*versal *Mo*toric Gerät. *Gerät* is the German for implement.

I saw the Unimog put through its paces at Quehanna, an 80-square-mile research and development center of the Curtiss-Wright Corp., in the muddy, mountainous wilderness of central Pennsylvania. A ground clearance of 18 inches (the machine's) and a fairly jolt-proof spine (mine) were helpful.

When the going got really tough, the

[*Text continued on page 130*]

POST HOLE? Farmer Kunes of Keewaydin, Penn., needed one in a boggy hollow that he couldn't get to with his tractor. With an auger attachment we did the job for him in a jiffy.

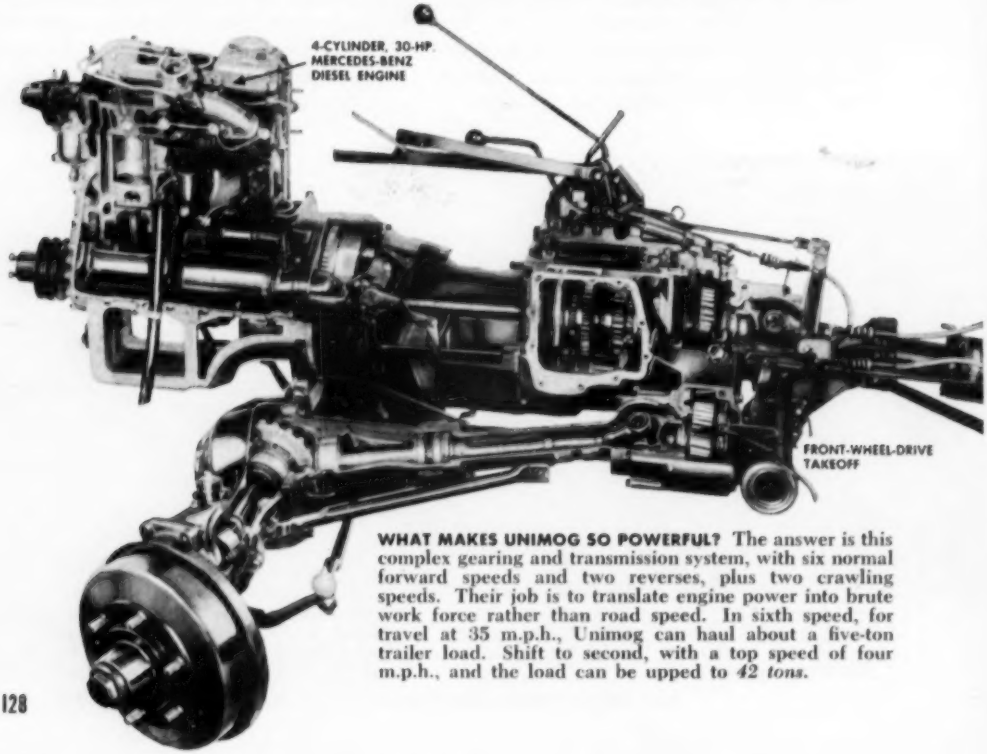
AS THE "FARMER'S FRIEND," our Unimog then operated a plow (above), corn planter, and rotary tiller, demonstrating only a few of the many farm implements to which it can be mated.

For more Unimog photos, please turn the page

For the rest of the day we Unimogged here and there

A FOREST FIRE (simulated) was then killed off on the way back to Quehanna. For this we mounted a tank and spray unit, filled the tank at a woodland pond with a jet-injection pump.

A BIT OF GRADING on a dirt road, using a scarifier, was the next order of business. Most of these pictures were taken by PS photographer Hubert Luckett in a drizzling rain.



WHAT MAKES UNIMOG SO POWERFUL? The answer is this complex gearing and transmission system, with six normal forward speeds and two reverses, plus two crawling speeds. Their job is to translate engine power into brute work force rather than road speed. In sixth speed, for travel at 35 m.p.h., Unimog can haul about a five-ton trailer load. Shift to second, with a top speed of four m.p.h., and the load can be upped to *42 tons.*

over wild and woolly acres . . .

WITH AIR COMPRESSOR mounted up front, we bumped over rough and rocky roads to a ditch that needed draining. A turbine-driven centrifugal sump pump sucks up the water fast.

AS DARKNESS FELL, a three-phase, five-KVA electric generator was put to work on a pavement-cutting job. Plugged in are a drill, a fan to blow out dust, and a floodlight to see by.

FIRST AMERICAN IMPLEMENT specially modified to work with the Unimog is this Shawnee "Scout" back hoe that can dig ditches up to 24 inches wide and 12 feet deep, and swing in a 150-degree arc. Its hydraulic system operates from the rear power takeoff. [*Please turn the page.*]

DEEP IN THE WOODS AGAIN, the back was loaded up with a ton or more of pulp logs. These we then dumped at the roadside by means of the vehicle's air-operated, self-tilting body.

THEN WE PARKED at the top of a steep grade and hooked the end of the rear-mounted winch cable to a 6,000-pound log. Power was put to the winch and the huge tree began a fast climb.

AS A FINALE for our Unimogging we posed the "beast" with a few of the several hundred attachments that are available from Germany, plus the U.S.-made Shawnee "Scout" back hoe.

driver put the Unimog into four-wheel drive and engaged the differential lock. Inching along, we got through.

For work, the vehicle has three power takeoffs: front, rear and side. Power from the rear can be split for a fourth takeoff to operate equipment, such as a welding unit, from the truck bed.

In this country the Unimog comes fairly high, as noted above. But there are indications that it will be made here, and if it is, the price will come down.

One reason for Unimog's price tag (aside from import duty) is its rugged construction. This is necessary not only because of the beating it must take over rough terrain, but so that it will hold together under the terrific torque put out by the small, four-cylinder diesel engine. At 2,550 r.p.m. it develops a whopping drawbar pull of 5,500 pounds. Each wheel unit, for example, is constructed to take full engine torque, which happens in four-wheel drive if only one wheel is getting traction.

Ordinarily a Unimog spends very little time traveling. It is usually involved in crawling, off-road operations or working at a standstill. That is why, for maintenance purposes, the mileage meter is generally ignored in preference to an elapsed-time meter that shows how many hours the engine has worked. In fuel consumption it gives 22 miles to the gallon on the road, or one hour of non-driving work on 1½ gallons.

Compression ratio of Unimog's engine is 19:1, compared to a high of 10:1 in a U.S. gasoline engine. This high compression ratio is a characteristic of diesel engines, which do not use spark plugs. Since cylinder-compression heat burns the fuel, there is no danger of pre-ignition. There is better combustion—more of the fuel is burned.

After several days of seeing the Unimog at work, I was invited by Dr. A. Feldmann, of the Daimler-Benz Co., for a spin in a sleek, low-slung Mercedes-Benz 300 SL. We tore down the 10-mile-long Quehanna private road at 120 m.p.h. That was play—not work—for the 300. But can it dig a ditch? END

He Runs a Floating Supermarket

Rivermen have never had it so good, since Jim Walden started his midstream grocery store.

By George Laycock

TIED to the shore in the bustling river harbor at Memphis, Tenn., is one of the country's most unusual and successful supermarkets. Its sales include everything from corn flakes to diesel oil—and all its deliveries are made out in the middle of the muddy Mississippi River.

This floating store, the Jim Walden Marine Supply Company, does a 1½-mil-

Pilot of the 32-foot "Jim Walden" totes load of groceries aboard for delivery in midstream.

lion-dollar annual business and is still growing.

Ex-Marine Jim Walden came up with his unusual idea about 10 years ago. Then, river-boat captains had to tie up at Memphis as long as seven hours simply to take on supplies. For a big tow boat, this could cost $100 an hour. Walden reasoned that if they could buy supplies in midstream they wouldn't even have to slow down at Memphis.

Starting out with $200, Walden rented a small boat and arranged to sell groceries for a Memphis store. Then he tried to meet boat captains in midstream, and talk them into buying groceries.

Walden struggled until he made a deal for a marine radio transmitter. He could now keep up a steady flow of calls to passing boatmen. Gradually they began to learn about his fair prices and fast service. Business picked up.

But selling only groceries, his margin of profit was small. What he really hoped to establish was a type of river delivery no one else had tried yet: He wanted to refuel river boats in midstream while they kept up full speed.

Lack of operating funds stopped him short. Then he met Charlie Smith and Smith came into the business with him. They bought the boats and delivery barges they needed for fuel oil, and told the river captains they were in business.

They sold 460,000 gallons of fuel oil in their first month. Fuel soon became the major sales item. The floating store now sells about $75,000 worth a month.

But Smith and Walden never get so engrossed in big deals that they forget the little things. "Service," says Smith, running the store while Walden is on sick leave, "is what we really have to sell." So the Boat Store handles laundry for crewmen, delivers mail and newspapers, cashes checks, provides emergency medical service. Up and down the Mississippi everyone is pleased with the way the new river service has turned out. The boat companies' profits have increased. The boat captains are meeting their schedules better. And Jim Walden's Boat Store is making money.

Supermarket's home base in Memphis harbor

AN ORDER FOR SUPPLIES is relayed by Charlie Smith, top man in the outfit, to his clerks back in the Boat Store. He's radiophoning from the Jim Walden out on the Mississippi River.

The delivery tug Tee Gee transfers fuel oil from

includes steel barge (left), to house grocery department, and old wooden headquarters barge.

CLERK SELECTS CANNED GOODS to fill a river captain's order. The average grocery list comes to about $250. Diesel-fuel orders sometimes go as high as $6,500 for a single large boat.

THE JIM WALDEN TIES UP to a passing craft so the crews can transfer supplies. The river captain ordered them by radio 12 hours earlier, while he was still 80 miles downriver.

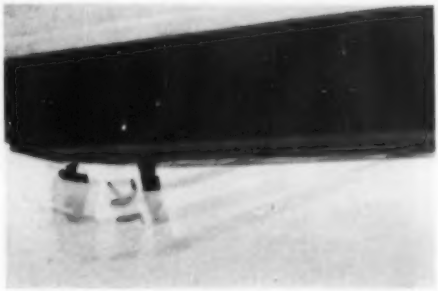
its barge to river boat (behind barge) pushing its own string of barges along the river. END

Aluminum tubes, subdivided into watertight compartments, make up the hull of a new pleasure craft that combines speed with safety. Short of a serious collision, it is almost impossible to sink or capsize the Hydromobile, even when maneuvering at 35 m.p.h., says its maker, Hupp Engineering Associates, Bloomington, Ill. Tail sections on either side of the outboard (left) serve as a platform for diving and climbing back aboard.

What's New Afloat

At home on land or in water, the Sportsman is both outboard cabin cruiser and a house trailer. When the owner decides on a change of scene after a sea voyage, he simply noses into shore, cranks down the retractable wheels, and hitches onto the family car. The novel 28-foot amphibian, made by the Neptuna Corp., Glendale, Calif., sleeps four and is equipped with complete kitchen facilities.

A few inches of water is all this inboard needs, and its propeller still won't scrape bottom. The reason, shown in the multi-exposure photo at right, is a device, developed by J. W. Daniels of Fort Myers Beach, Fla., that automatically adjusts the rudder and propeller according to varying water depths. When a hinged skeg, or protective "mud shoe," touches bottom, it forces the unit up out of the way so that it clears obstacles safely.



Aluminum tubes, wheels and props that retract, and a floating playroom, add up to more fun—and safety, too.

Just for fun afloat, here's a recreation and rest pavilion on a raft. Roomy as a rumpus room, it has a shaded, screened-in area for meals and use at insect-swarming time. Surrounding it is plenty of open space for entertaining friends. Powered by two outboards for leisurely cruising along inland waters, the craft cruises along so steadily that the youngsters have to supply the rock-'n-roll.

They cruise 5,000 miles to nowhere:

The Offshore Radar Ships That Protect Our Cities

NOSING SEAWARD for a desolate but crucial 30-day voyage in empty Pacific waters, the picket ship Scanner leaves port. She carries air-search, height-finder and surface-search radars.

SHIP'S SCOPE WATCHERS, relieved by a fresh crew every 20 minutes to prevent eyestrain, spot blips that warn of intruders within radar range, notify men at the plotting board (below).

By Wesley S. Griswold

FLOATING sentry posts are rapidly closing gaps in the invisible shield of radar designed to protect us all from surprise attacks by enemy planes.

By July, 36 naval vessels crammed with apparatus for scanning sky and sea for miles beyond the limit of man's vision will be plowing through lonely waters off our east and west coasts. Many of them are already at their dreary patrol duty, helping blimps and radar-equipped planes and Texas Towers (PS, Oct. '55) guard our seaward flanks, while three continent-wide chains of radar outposts (PS, Aug.-Sept. '56) are fast being forged to forestall sneak air raids across our

TRACKING DISTANT PLANES, which may be friendly or hostile, crewmen at the transparent plotting board record the aircraft's speed and courses, phoned to them by the scope watchers.

IN CONSTANT TOUCH WITH LAND, the Scanner's radiomen keep the ship's Combat Information Center linked by radiophone with an aircraft control and warning center on the Pacific Coast.

northern land approaches. More than half of the radar picket ships are maintaining a constant, roving vigil far beyond the nation's Pacific shore, in water much too deep for Texas Towers.

I visited one of these ships, the USS Scanner, to find out how it performs its urgent task and what life aboard is like.

Back from her first taste of solitary patrolling along a heaving beat 300 miles off the West Coast, the Scanner lay at anchor in San Francisco. Her four radar antennas, resting from a full month of ceaseless gyrating, stood still in the sunlight while curious gulls wheeled above.

DEEP down in this converted Liberty ship lies the big, air-conditioned room that is the reason for her existence, the Combat Information Center. Here are the scopes on which vigilant men watch around the clock for the moving blips that are aircraft, often unseeable except to electronic eyes, approaching or leaving or skirting the coast.

Here is the brightly illuminated geographical plotting board, a lively pattern of grids and circles on a vertical screen of transparent plastic. On this board are marked in chalk dots the paths of planes spotted by the watchers at the scopes.

Here, too, sits the C.I.C. watch officer, facing the plotting board, with instant, constant radiophone contact with the Aircraft Control and Warning Center on top of distant Mt. Tamalpais, just north of Golden Gate.

Five men are on duty at all times, 24 hours a day, seven days a week, in the C.I.C. But no scope watcher is allowed to stay at his post for more than 20 minutes at a stretch, lest he develop "scope fatigue."

"WE TRACK and report every airborne object we contact," the C.I.C. watch officer told me. "So far, they have all been planes." With a laugh, he added, "And all friendly.

"We are given two minutes to establish the aircraft's track before calling Mt. Tam. And Mt. Tam is allowed three minutes to find out whether the aircraft is friendly or not, by means of a coded system of challenge and answer that every friendly pilot is equipped to comply with. If identification isn't certain, Mt. Tam orders a scramble of interceptors. They get off fast. In less than seven minutes from the time we pick up a track, jets can be on their way out to have a look at the 'unknown.' "

"Can you guide them to it?" I asked.

"Oh, yes. If the 'unknown' is out beyond shore radar control, we can take over and direct the interceptors to the target."

"How far can your radars see?" I asked.

He replied guardedly, "Well, we once picked up land as far as 120 miles away. Our long-range radars spot surface craft at 25 to 30 miles. We can detect planes farther away than that."

DID his boys make many radar contacts?

"It depends on where our station is," he replied. "There are 600 scheduled flights into and out of the U.S. every day, and a goodly share of them approach or leave the West Coast. Still, if we don't happen to be sailing near an air-traffic lane, we don't get much business. We've had as many contacts as 40 in 24 hours and as few as one."

"In other words, life can get mighty

dull here on the Scanner," I remarked.

"It can," he said.

Yet among the crewmen I talked to on the Scanner only one didn't like the vessel. Peevish Pete hated it.

"What's wrong with life aboard a radar picket ship?" I asked.

"Sir, it just ain't no fun," he said.

Inspecting the Scanner, I had looked with wonder at her movie theatre, where a new film is screened each night; basketball court; hobby shop, loaded with power tools; boxing ring; Ping-pong tables; golf driving range—all provided in the cavernous compartments that once were cargo holds in this ex-freighter.

I had peered into the tidy, commodious bunkrooms; seen an absorbed group of sailors at the soda fountain; heard the ship's hi-fi radio; noted the several TV sets, all resonating with noisy entertainment; eaten excellent food in a warm messroom; overheard old hands gleefully sending earnest novices in search of stretchable ladders and enjoying other time-honored nautical gags.

IN VIEW of all this, the Scanner certainly seemed to be a happy ship.

"Pete," I said, "I think you're just plain hard to please."

He looked at me with bitter distaste.

"We don't *see* nothin'," he said angrily. "No land, no ships, no mail—no dames. What we get is fog and rough weather, and foghorns blattin' all night."

"Doesn't the ship get mail?" I later asked the Exec, a ruddy young man.

"Nope. You see, we go way out beyond copter range, and nobody's rigged up a delivery service by seaplane or ship. But we're just getting started. The Navy'll get around to it," he added confidently.

"How far do you travel in a month?"

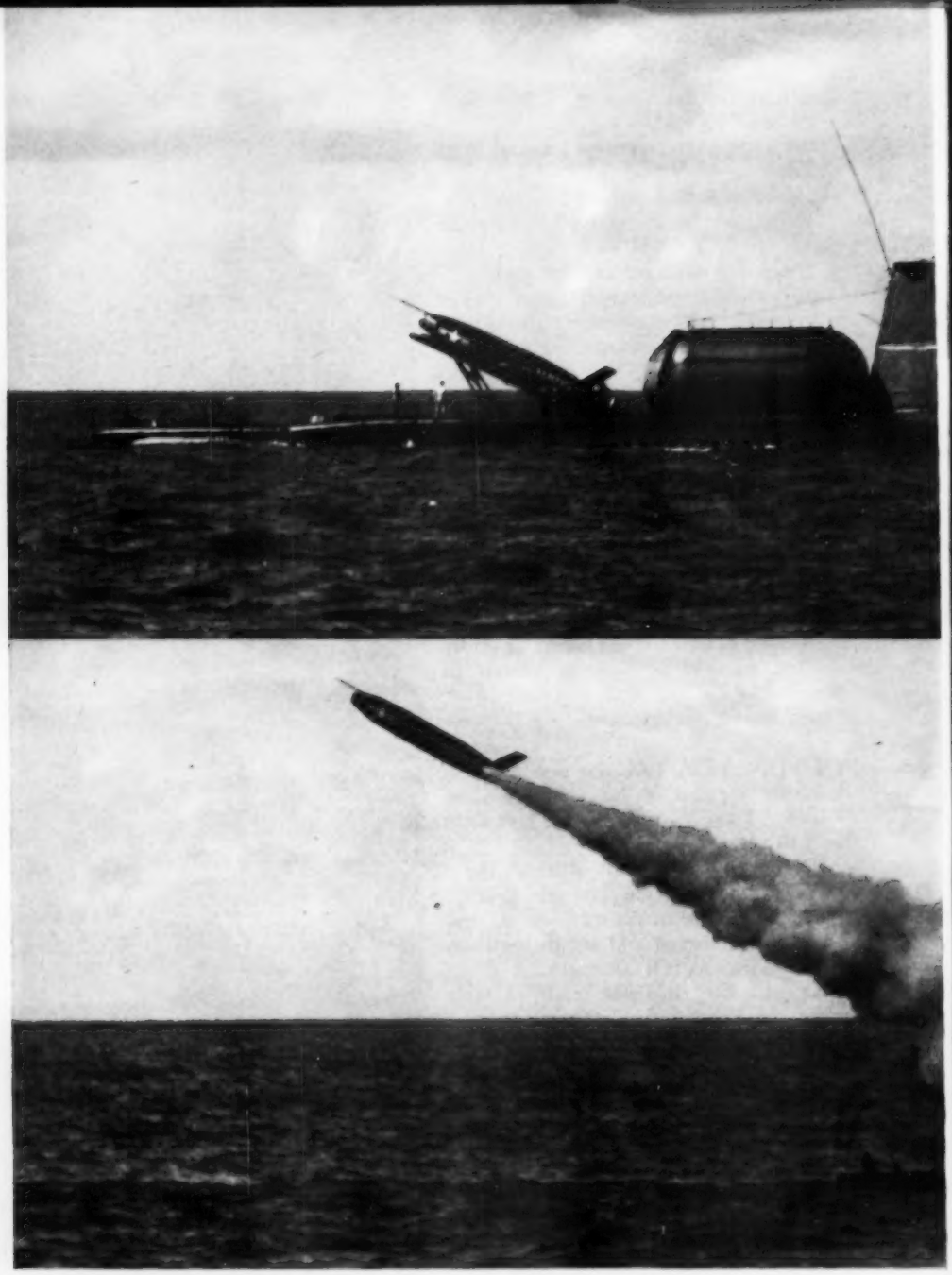
Cautiously, he replied, "Oh, around 5,000 miles. I can't tell you what kind of course we steer. That's classified."

"And you never actually get anywhere?" I said.

"That's right," he agreed cheerfully. "Except back to port—at the end of every four weeks."

[*Continued on page 234*]

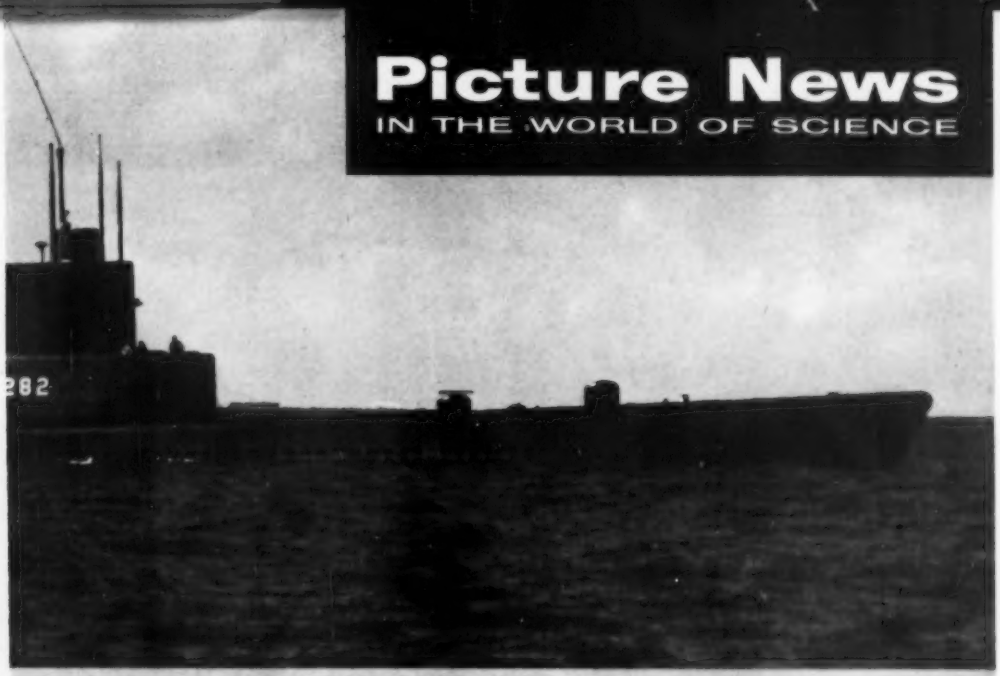
A SCRAMBLE STARTS at the nearest interceptor base five minutes after the Scanner's radars, hundreds of miles away, have picked up an aerial intruder that can't prove it is friendly.

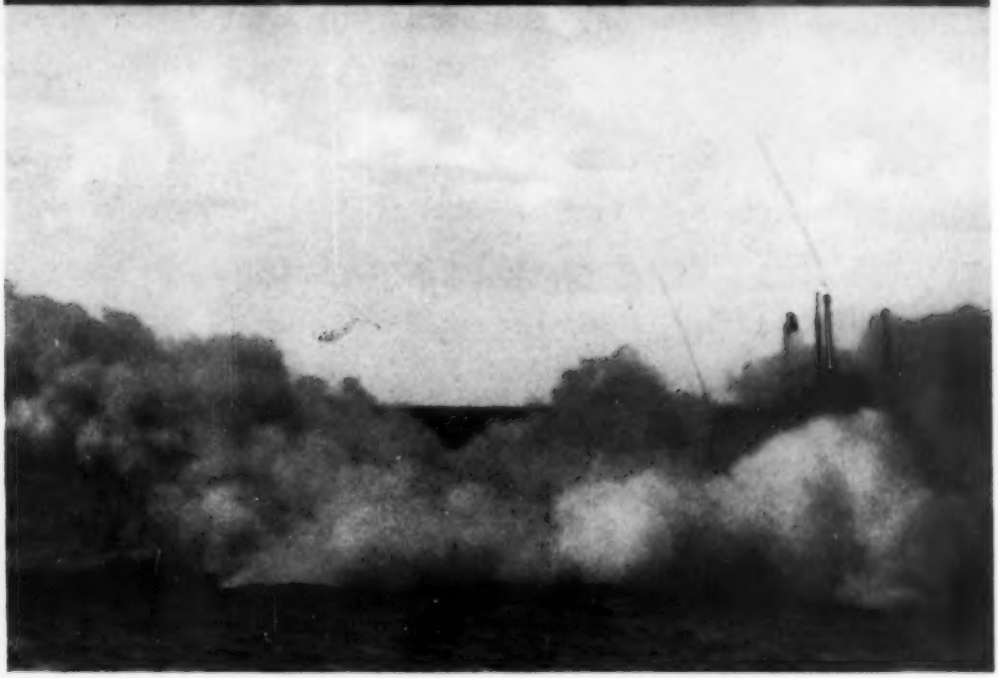


Missile Has Own Hangar on Sub Until It Roars into Sky

MOVED out from its deck hangar to a launching platform, a Regulus I guided missile is prepared for firing in this picture sequence just released by the Navy. At right, it roars skyward, hiding the sub in a cloud of smoke. A new supersonic, long-range version, Regulus II, is

Picture News
IN THE WORLD OF SCIENCE

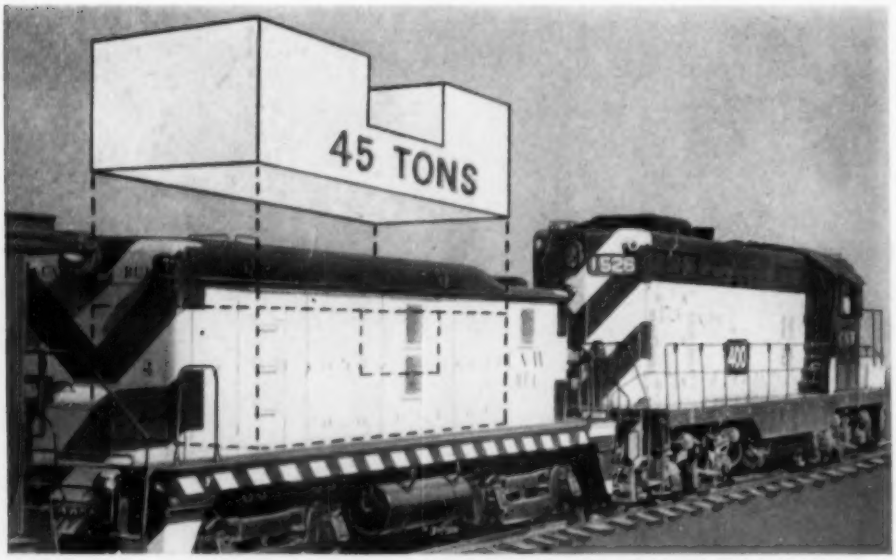




now under development. It has retractable landing gear and an electronic "brain" that will bring the "bird" back after it drops its warhead. Although Regulus II is intended for sub, ship and shore firing, it could be launched from bombers such as the B-52 or B-58, enabling them to release their nuclear packages hundreds of miles from a target.

Down-to-Earth Subjects Are Majors in New School

THERE'LL be no passing marks for this student if he continues to throw the dirt from his tractor's hydraulic shovel over to the far side of the dump truck. This is only one phase of the comprehensive course in earth-moving recently established by Greer Shop Training, Inc., of Chicago. The students practice on 600 acres of good earth near Joliet.



Concrete "Engine" Plugs In for Diesel-Electric Power

CONCRETE treatment has prolonged the life of an obsolete diesel engine on the Chicago and North Western Railway. With its diesel unit removed, and the weight replaced by a block of concrete, it serves as a second, or booster, engine, receiving electric power for its traction motors from a normal diesel. It is used in freight yards.

Shock Wave Shows What Bullet Does to Sound Wall

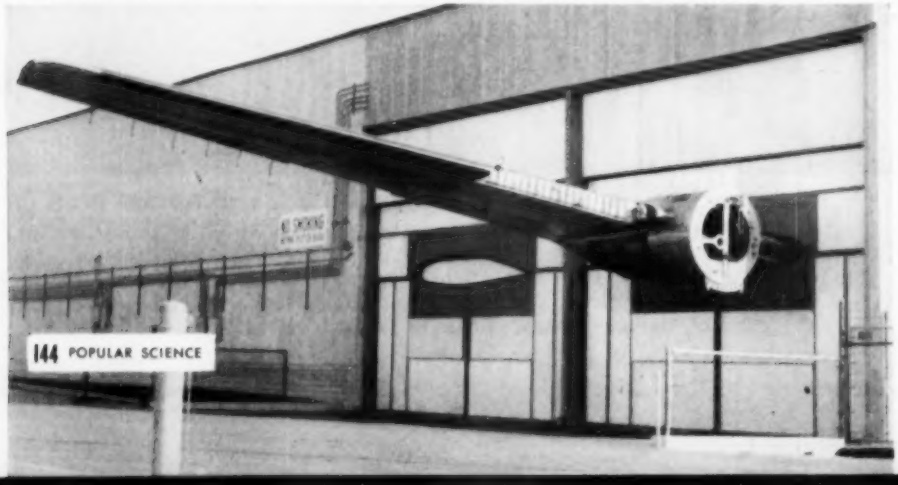
THIS photo of a bullet passing through the flames of three candles is a visual demonstration of supersonic missiles breaking through the sound barrier. Using the "schlieren" method, Prof. Hubert Schardin of Germany photographed it at 1/10,000,000 of a second. Above the candles, the shock wave of the projectile is refracted in the heated air.

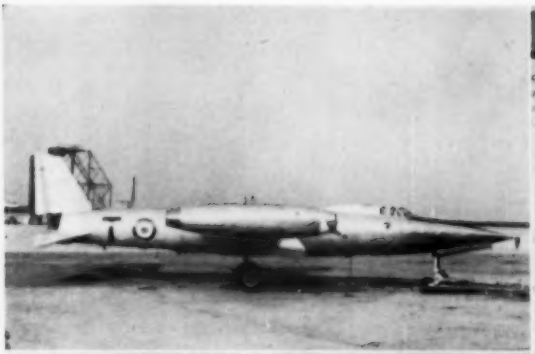
Doorless Czech Car Has Look-Alike Front and Rear

USE of the same molds for both front and rear of the body brings down the cost of the Avis, a 750-pound baby Czechoslovakian car. There's no door; instead, part of the body slides to the rear. The driver sits behind a centered steering wheel; two passenger seats are set back on either side. A 14-hp., two-cylinder rear engine drives the car at 50 m.p.h.

Big-Wing Constellation Outgrows Its Workshop

RESEMBLING a huge "turn-right" signal, the outboard wing section of a Lockheed Super Constellation airliner sticks out through a slot in the door of a tank-sealing shop at the company's Burbank, Calif., plant. Reason is that the wing span of the Super Connie has grown from 123 to 150 feet, necessitating this strange wing-sprouting structure.



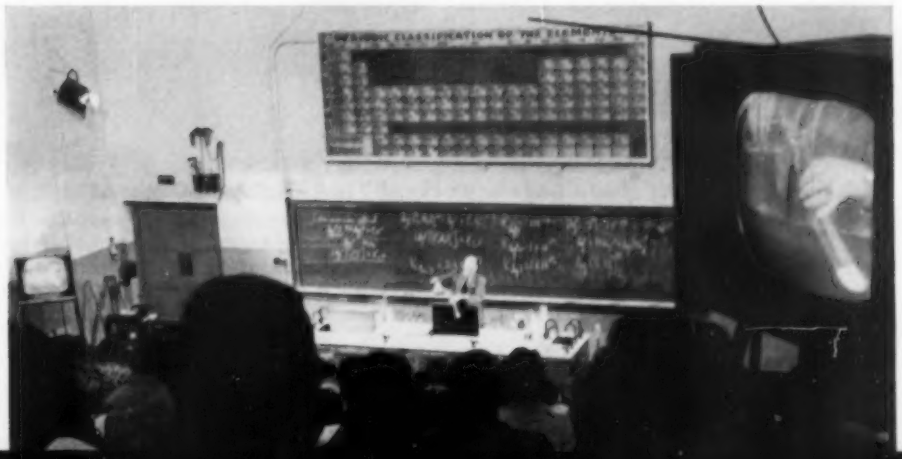


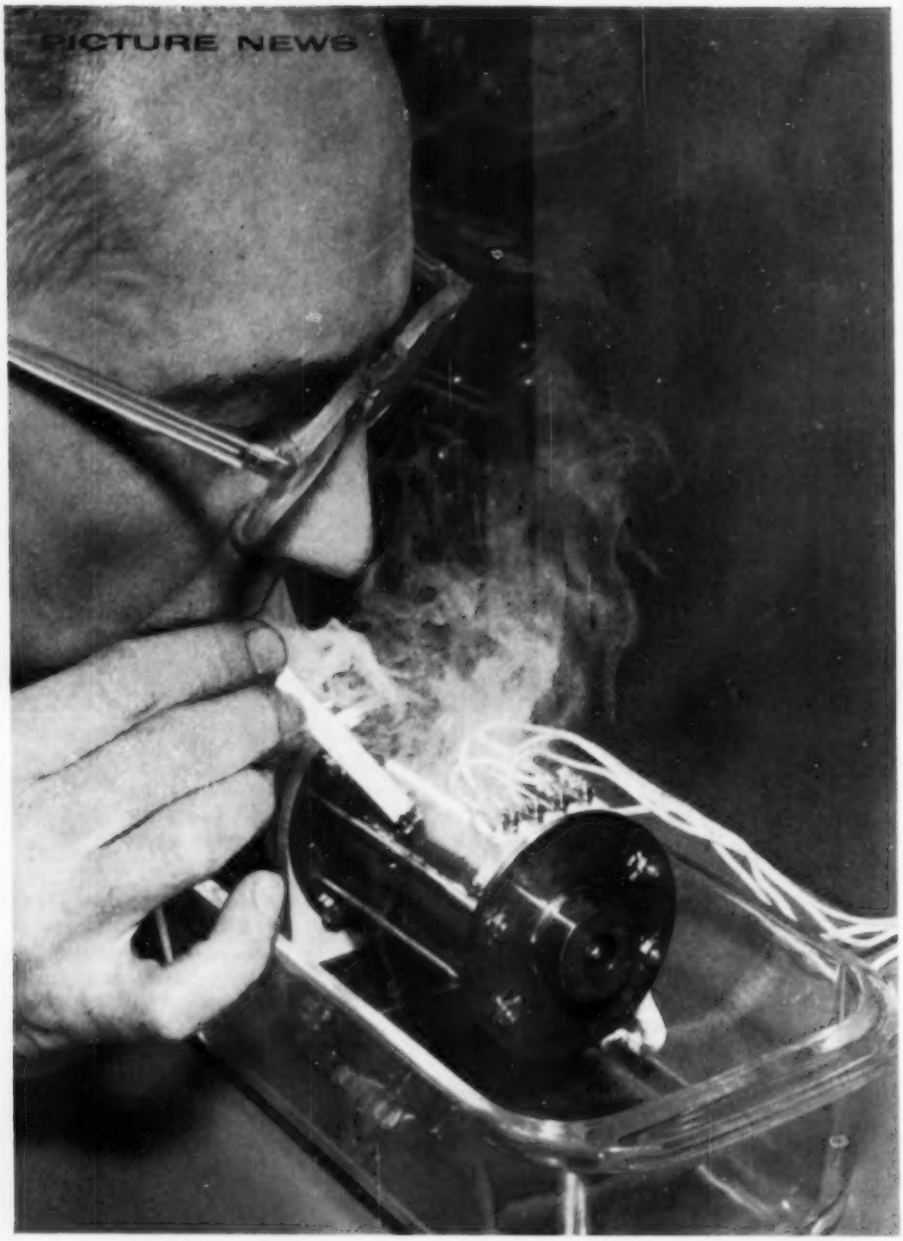
Dummy Shows Dress for New High-Flying French Jet

TRIDENT II is a supersonic interceptor powered by jet engines at the wing tips and a rocket unit (shown blasting away at lower left) at the rear. The French say that its altitude is limited only by the pilot's ability to take it. This means a pressure suit, which was shown recently in Paris by a model sitting in a new type of ejection seat.

TV Brings Visual Instructions to Larger Classes

IN A large auditorium, such as the one below, only those sitting in the first few rows could easily see the chemistry experiment being conducted by an instructor at Pennsylvania State College. But by means of closed-circuit television with multiple receivers, two of which are shown, every student gets a close-up view of what is going on.



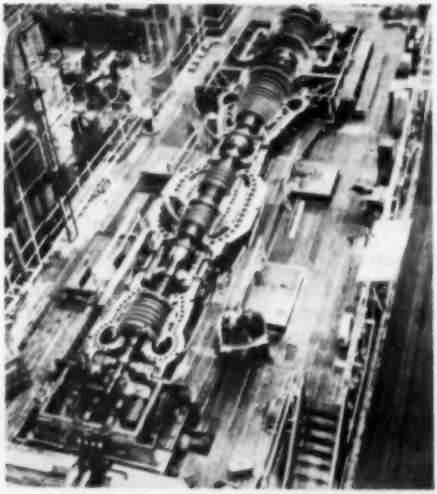


Motor Runs Safely at Heat That Lights a Cigarette

RUN for 50 hours at temperatures of more than 900 degrees, this tiny 400-cycle electric motor gets hot enough to light cigarettes without burning itself out. Such heat-resistant equipment will be necessary for the controls of tomorrow's hypersonic planes and missiles. As a bonus, the General Electric motor also is resistant to nuclear radiation.

Guided Missiles Go to Sea Aboard a Destroyer

TWIN Terrier launchers aft distinguish the USS Gyatt, first of 16 World War II destroyers that the Navy is equipping with guided missiles. In addition to the supersonic Terriers, the Gyatt carries the latest detection devices and weapons for destroying submarines. Two cruisers have also been converted to guided-missile ships (PS, July '56).

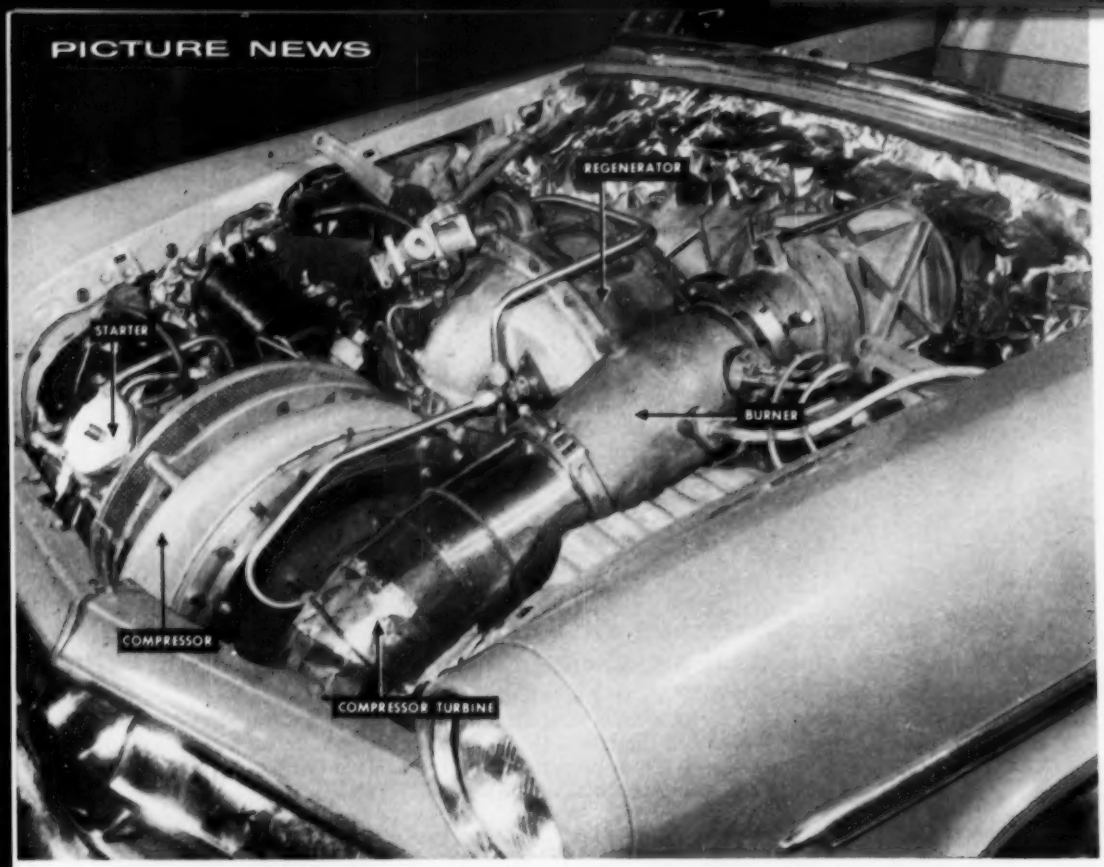


Steam Will Spin Giant Turbine

STEAM at the rate of 2,800,000 pounds an hour will travel through the throat of this huge new turbine when it is installed in a power plant at Linden, N. J. This is said to be the largest steam flow of any turbine now in existence.

How Did That Pole Get There?

IT *was* there when an emergency siding was being put through in Wellington, N. Z. Instead of delaying the job, workmen built right through, omitting a few ties. Yes, they came back and removed it before clearing the track for traffic.



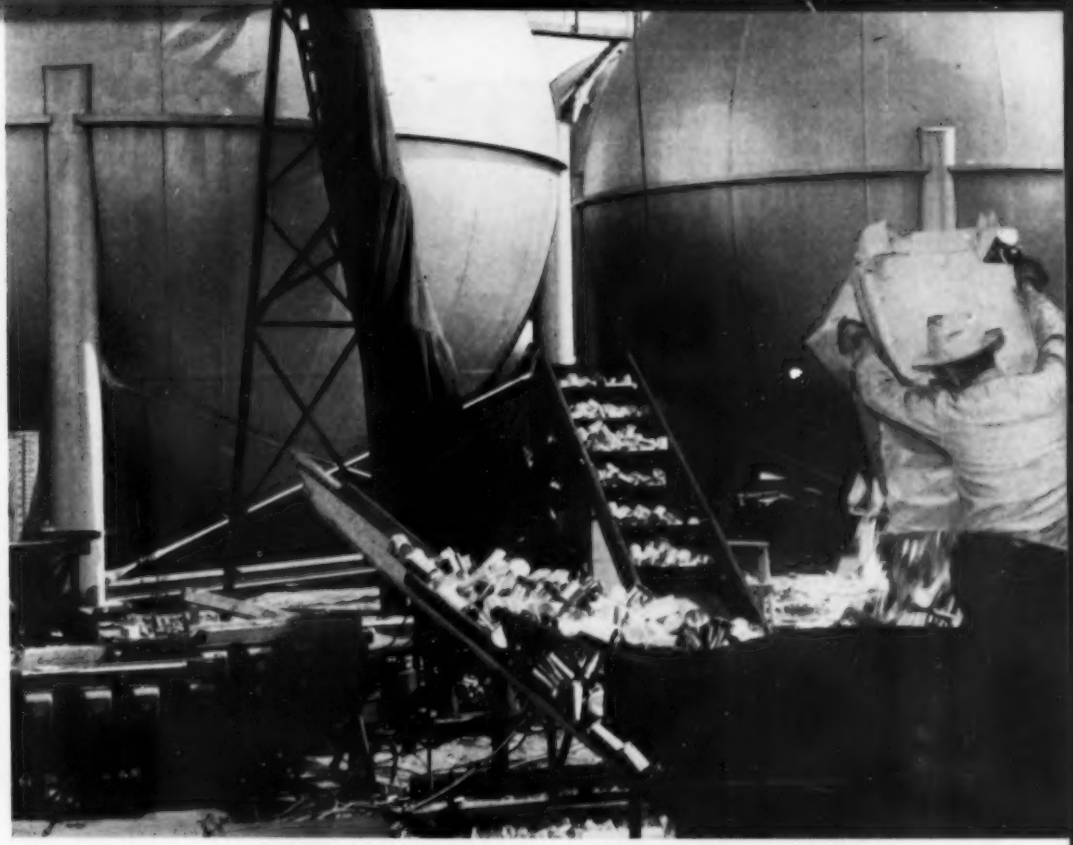
How a Gas Turbine May Look Under Hood of Your Car

FORD has been added to the list of Detroit manufacturers who are experimenting with gas-turbine engines. Pictured here is its experimental automotive turbine, squeezed snugly into a 1954 model designed to carry a V-8. In this phase of development, Ford appears to be depending on the regenerator shown at center to increase fuel economy.

A "Galaxy" Is Born: Tiny Nuclear Guns Simulate Cosmic Birth

THE split-second sequence below of ions swirling at 450,000 m.p.h. in a partial vacuum gives a clue in miniature to the birth of a star galaxy that may have taken a billion years. The luminous "plasmoids" were shot simultaneously from eight "plasma guns" into a four-inch glass jar surrounded by a magnetic coil.

The guns were developed for thermonuclear research by Dr. W. H. Bostick of

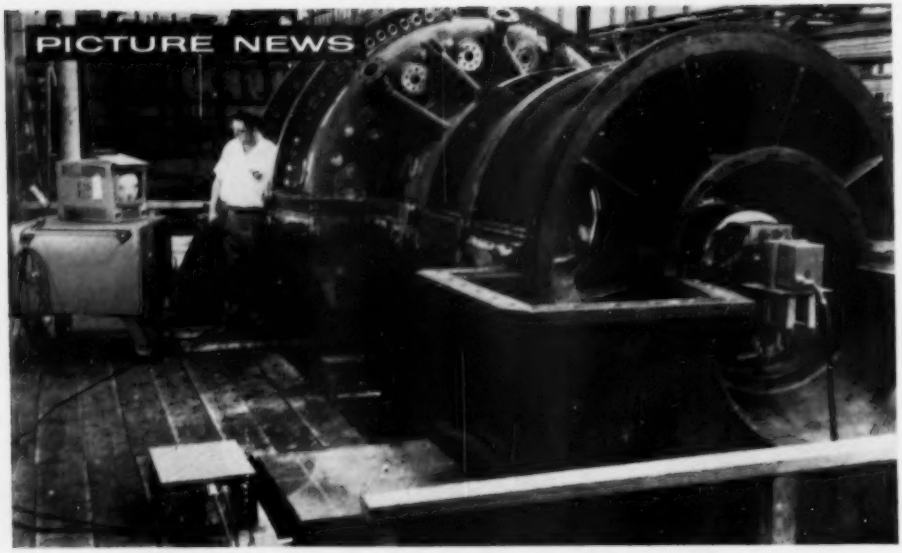


8,000,000 Tin Cans Keep Wind Tunnel's Air Warm

INSTEAD of using expensive heaters, North American Aviation loaded the eight compressed-air storage spheres of its new subsonic-supersonic wind tunnel with a million tin-can rejects each. As heat exchangers during test blows, they hold a possible 200-degree drop in air temperatures to a workable 30. The tunnel provides wind speeds up to 2,500 m.p.h.

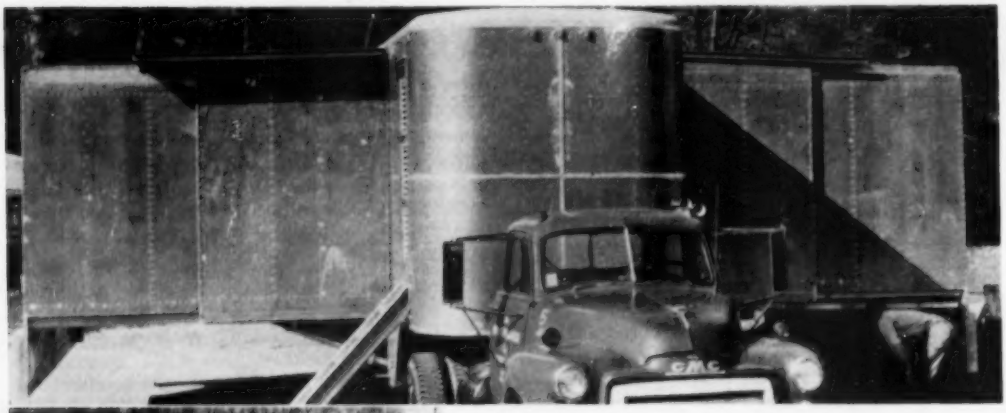
Stevens Institute of Technology. Each is about the size of a lead-pencil eraser and consists of two titanium wires, impregnated with deuterium (heavy hydrogen) and embedded in ceramic. A 10,000-amp. electric arc leaps the gap, vaporizes the wire ends and shoots an ionized hydrogen pellet across the magnetic field. Spirals resulting when several guns are fired at once strikingly resemble stages in the evolution of heavenly galaxies.

Dr. Bostick suggests that ionized hydrogen in outer space may likewise form plasma jets that become stars and planets.



Closed-Circuit TV Aligns Sections of Big Gas Turbine

WITH a telescopic-lens TV camera (right foreground) centered on one section of a gas-turbine shell, this General Electric operator aligns a second section by watching its position on a monitor screen. Then he bolts the assembly. The setup is designed for rugged, low-light conditions.



Truck Too Small? Push a Button

ON THE road, a new 14-ton aluminum trailer truck measures a conventional eight by 35 feet. But halt it and push a button, and a hydraulic system pushes out its sides to 26 by 30 feet, drops accordion-folded floors into place, and leaves a five-foot foyer.

Gerstenslager Co., truck-body builders of Wooster, Ohio, sees military, industrial and mobile-home uses in prospect.

Ultrasonic Track Skimmer Spots Defects in Rails

RIDING the rails of New York City's subway and elevated system, a "trackwalker" now spots in three weeks as many rail breaks as 267 men on foot find in a year. His apparatus is a cathode-ray unit in a diesel car which he drives with one hand while skimming a quartz crystal over a rail with the other. The crystal sends an ultrasonic beam into the rail, which reflects it to a screen, showing up even defects too small to be seen.

One-Shot Flame Thrower Is Tested for Paratroopers

UNDER test by the Army Chemical Corps, this compact flame thrower can be jumped with a paratrooper for fighting at close quarters. It weighs 26½ pounds combat-loaded, compared with 72 pounds for a multiple-shot model, and discharges two gallons of fuel in a single burst. It can be fired by hand or remote control, or adapted for use as a booby trap.

Back Pack Drives Roller Skates

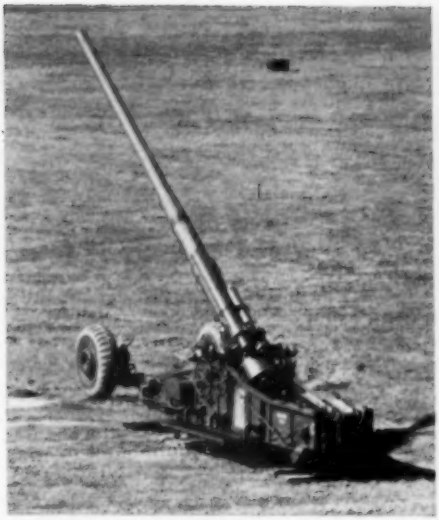
ONE-FOOT roller-skate power is not only economical but solves the parking problem for Bernie Schmidt of Detroit. A small gasoline engine, mounted on a padded metal plate and strapped to his back, transmits power through a flexible shaft to the rear wheels of one skate.

Baby Carriage Goes Down Steps

BUMPING baby on steps or over curbs is eliminated by a hinged device on each side of the chassis that drops the two front wheels so that the carriage remains parallel to the ground. An air cylinder returns the wheels to normal position.

Aluminum Cuts Rifle Weight

SO LIGHT that it floats on water, this new survival gun has an aluminum barrel with stainless-steel liner. Developed for the Air Force by the Fairchild Engine & Airplane Corp., the weapon holds a compass, matches, fish hooks and line in a fiberglass-and-plastic stock.



Big Gun Gets into Fight Fast

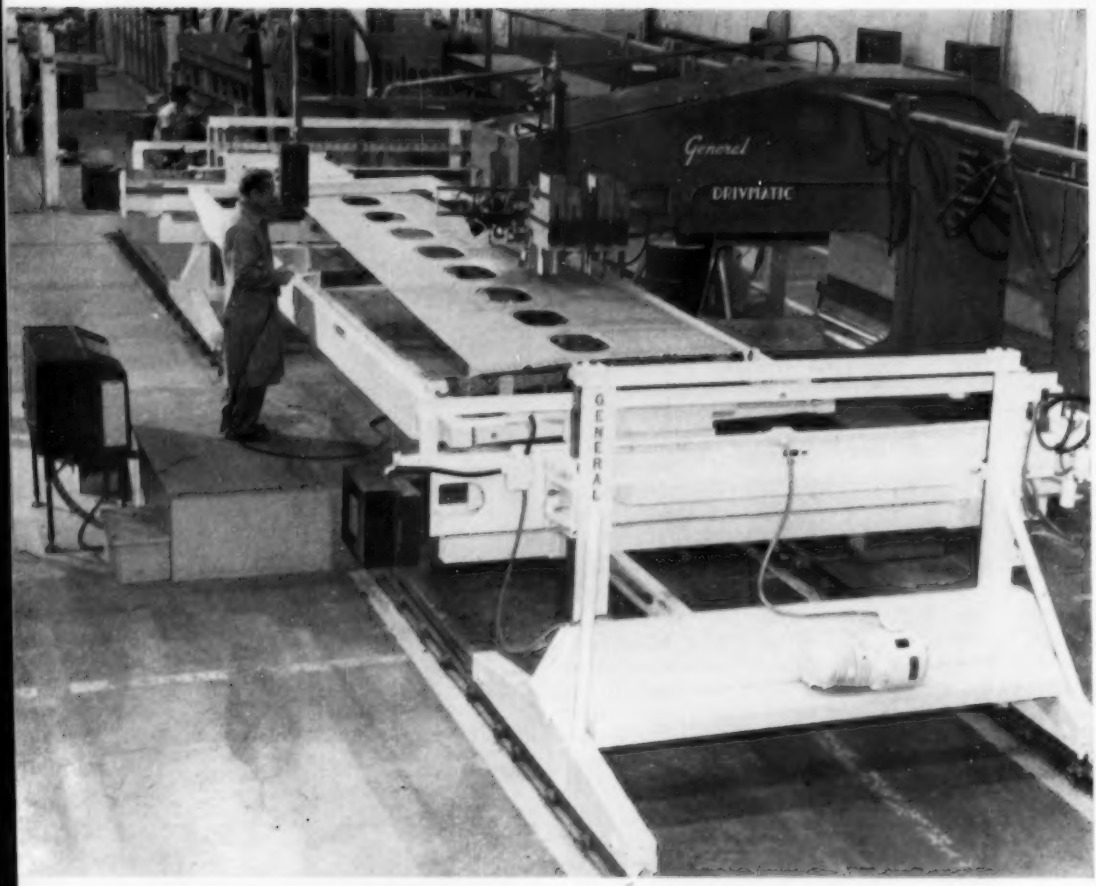
THE newest in field artillery is the 175-mm. T45, which goes into action fast. There is no need to dig a recoil pit. Hydraulic-electric power reduces work of the gun crew, and sights read directly in numbers instead of off micrometer scales.

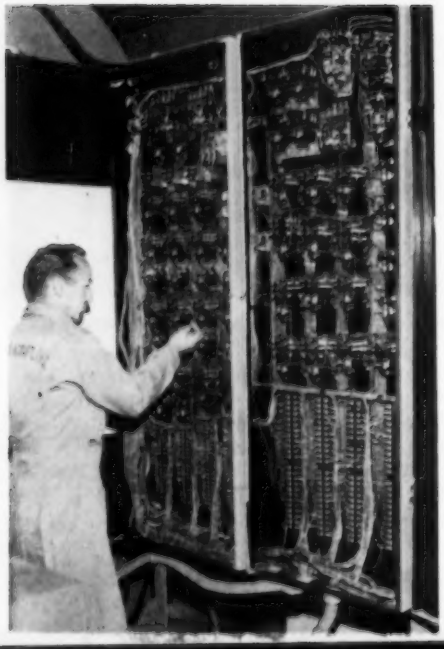
Traffic Cop Shines in the Dark

POLICEMEN on traffic duty in West Berlin are now able to light themselves up when night falls or the weather turns bad. Yellow bulbs are spaced on a harness belt, three in front and three in back. The lights operate from a small dry battery carried in an under-arm pouch.

City Gets Miles of Fluorescents

NEW York City's Third Avenue recently became the world's longest fluorescent-lighted street—7½ miles. The Westinghouse installations (top photo) are placed 100 feet apart on alternate sides. The lower photo shows an experimental GE fluorescent highway system.





Giant Push-Button Riveter Mass-Produces Aircraft Wings

THIS completely automatic machine puts holes and rivets in a 20-foot wing section at the rate of seven of each a minute. It needs only one man (to push start and stop buttons) instead of five needed on hand jobs, yet it turns out wings at Northrop Aircraft four times as fast.

The two black boxes attached to the ends of the traveling bed contain punched tapes that allow pinpoints of light to actuate electronic eyes that guide the work transversely; the console behind the operator controls longitudinal motion and tools that drill, ream, countersink and rivet.

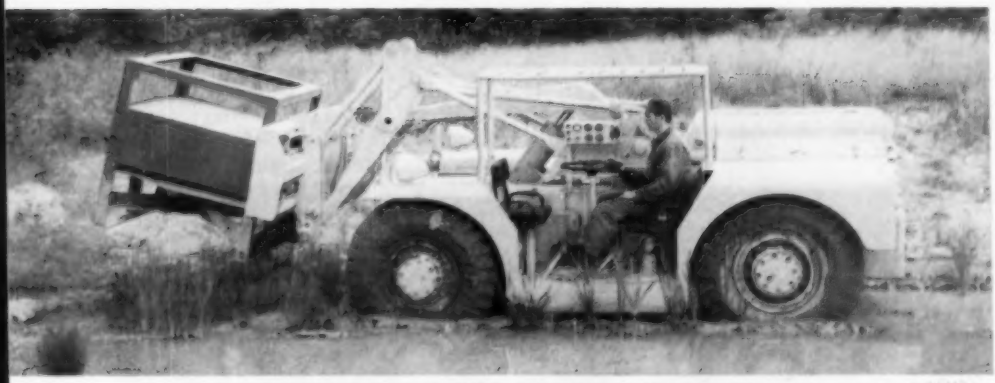
At left is a portion of the "brain" behind the operation: a complex circuit that acts on the messages received from the electronic eyes.

Army Tests Field Chute Dryer

A BIG edition of the family wash dryer, this combination wringer and hot-air blower dries 300 Army parachutes in 24 hours—quicker and easier than hanging them on the line. It can be airborne, in 23 packages, for laundry work in the field.

1915 Roadster Has Baby Brother

GEORGE MONTILLIER, San Mateo, Calif., is so fond of his 1915 Ford that he built one like it for his son, Gregg—with artistic license here and there when he couldn't duplicate parts. The little car has no motor; it goes by pedal pushing.



Swamp-Buggy Fork Lift Carries 6,000-Pound Load

DESIGNED for handling and storing cargo at forward airstrips before the storage area is leveled and surfaced, this Air Force fork lift is at home in mud and on rough ground. Its parallelogram arm folds to let it into and out of planes. Two seats permit the driver to face either way.

Our First Supersonic Bomber Outruns Jet Fighters

THE Convair B-58 Hustler, shown here in the first official Air Force photos, outdistanced an F-100 jet interceptor during early flight trials. A delta-wing plane, the B-58 is small for a bomber, 95 feet long, with a wing span of 55 feet. It has four underslung J-79 GE jet engines with afterburners for bursts of high supersonic speeds. Since there is no bomb bay, the Hustler will carry its weapons, bombs, rockets or guided missiles—conventional or nuclear—slung below the fuselage. The new strategic bomber, designed to fly at 50,000 feet, carries a crew of three.

New Ideas from the Inventors

1 Tractor Rig to Mix Concrete. This crane-necked, bucket-ended tractor attachment might save construction time by minimizing the hauling of dry ingredients and mixed concrete. The tractor would fetch and carry, and the attachment—using the tractor's power takeoff—would rotate, lift and tip the bucket.

2 Scoop to Measure Shortening. With this adjustable scoop, a cook could measure out shortening quickly and accurately. A sliding thumb button in the notched handle would set the scoop's capacity, and a forward push would scrape its contents cleanly into a pan.

3 Shoe Purse to Free Hands. A lady who finds it inconvenient to tote a pocketbook every time she goes to the store might find these money-carrying shoes handy when she wants to keep her hands free. The purses would be made to resemble ordinary shoe buckles.

Please turn the page for more new ideas

More Inventors' Ideas

4 Brush Guide to Mask Paint. The guide roller on this adjustable brush holder would make it simpler to paint a straight line or up to a given point. Set for trimming window sash, as shown, the roller would both guide the brush and help keep paint off the glass.

5 Light Fixture to Fight Fire. Installed in a home or office, this modern chandelier would double as an automatic fireman. A heat-sensitive spray valve would be built into the base, and the reflector bowl would hide a plastic container filled with a fire-quenching fluid.

7 Inflated Tanks to Float Plane. A ditched plane might have a better chance of staying afloat if it were equipped with these balloonlike tanks. During normal flight they'd be largely enclosed within the wing and fuselage, but in an emergency over water, they could be inflated to form pontoons.

6 Wiper to Clear Mirror. You wouldn't have to stop your car or squirm out of your seat to clean rain blurs off this rear-view mirror. Its small wiper blade would be worked from inside the car through a shaft-and-plunger hookup similar to a camera shutter-release cable.

8 Lid to Turn Can Into Ash Tray. By snapping on this rimmed attachment, you could convert an empty tin can into a man-sized ash tray. The receptacle wouldn't be likely to scatter ashes, and when it did get full, you'd just throw it away and snap the lid on another can.

9 Blind to Block View, Admit Air. The two independent sets of slats on this Venetian blind would let you close the lower slats for privacy, as shown, yet open the upper ones to admit light or air. The single pull cord provided for each set would rotate the slats both ways.

The following patents *have been issued on these inventions: 1. Patent No. 2,706,623 to Fred Styer, Detroit; 2. No. 2,747,410 to Pauline Dubin, San Luis Obispo, Calif.; 3. No. 2,712,700 to Frank Solomon, Brookline, Mass.; 4. No. 2,712,667 to Wilmer Stearn, Philadelphia, and Nickolas Thesen, Roslyn, Pa.; 5. No. 2,759,546 to Charles Zabriskie, NYC; 6. No. 2,722,707 to Harry Masselman, Nazareth, Pa.; 7. No. 2,711,868 to Kenneth Parker, Janesville, Wisc., and Neil Tillotson, Wellesley Hills, Mass.; 8. No. 2,714,464 to Martha Cline, Moscow, Idaho; 9. No. 2,706,522 to C. White, Waban, Mass.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

New Aids to Living

1 A light that "breathes" out cool air is being installed by the workman above. Air from a built-in diffuser behind the fluorescent light bypasses the lamp and emerges in a thin stream without drafts. By eliminating separate air-conditioning and lighting fixtures, it reduces construction costs.

2 Mechanical fire blower huffs a tiny spark into a roaring blaze fast. This firemaker sits flat on your fireplace hearth or hooks over the edge of a charcoal grill. Batteries supply the lung power and a control vane aims the draft.

3 Open-window lock gives you safety and fresh air at the same time. Fastened to the top sash, it secures the opened sash in three different positions. When the window is locked shut, the ventilating arm folds down flat.

4 A TV antenna—not just a trellis—that does the job of a rooftop aerial is what you see here. The aluminum Ground-Master is said to be unaffected by metal sheathing, insulation, wire screens or home appliances. To make it impervious to moisture and growing vines, there's a special covering on active elements.

5 Rotating heels give you more mileage while keeping you on an even keel. A circular insert turns as you walk so that wear on the rubber is evenly distributed. You can also lock the insert and turn it by hand as the heel begins to wear.

6 Electric toothbrush comes with interchangeable brush heads for each member of the family, and refill brushes (foreground). A fractional-horsepower motor spins the brush and stops it automatically if too much pressure is applied.

More information *about the products shown on these pages can be obtained from: 1. Pyle National Co., 1334 North Kostner Ave., Chicago, Ill.; 2. Abercrombie & Fitch, 360 Madison Ave., New York, N.Y.; 3. Slaymaker Lock Co., Lancaster, Penn.; 4. Trio Mfg. Co., Griggsville, Ill.; 5. Heelcraft Co., 1817 West Willard St., Long Beach 10, Calif.; 6. Proral Corp., 115 West Ash St., Springfield, Ill.*

Gus Fixes a Traffic Ticket

Could Gus cop-proof a car that acted up only over 50 miles an hour—and then did a snake dance in the middle of the highway?

By Martin Bunn

THE Model Garage had just opened for business when a call from Judge Morley Walker brought Gus Wilson to the phone.

"Gus," the judge said, "I've a case of traffic violation coming before me later this morning that I'm pretty sure will involve you before it's cleared up. I suggest that you get in touch with Officer Corcoran and discuss the case of the People versus Pearson."

"How's that?" Gus queried. But the judge had hung up.

"*Now* what have I done?" the bewildered proprietor of the Model Garage demanded of his helper, Stan Hicks.

Stan chuckled, when told the circumstances. "If I were you, I'd call Jerry Corcoran and plead guilty," he advised. "You're in bad, Gus."

Gus, puzzled, put in a call to Corcoran.

"Pearson?" Corcoran said over the phone. "Why sure, I know all about that case. We're beginning to think this guy is nuts. His record shows that he's been driving for years without a traffic violation. But within the past month he's been arrested three times for reckless driving. I wouldn't be at all surprised this morning if Judge Walker suspends his license for a couple of months."

"That sounds bad, Jerry," Gus said. "But where do I come in on all this?"

"I wouldn't know," Corcoran said. "But if Judge Walker called you on it, I've a hunch you'll find out before the day's up."

Gus discovered that Corcoran was right when a long-hooded car pulled up before the Model Garage. Its driver whipped open the door, popped around to lift the hood and peer suspiciously at the motor. The man was considerably over six feet tall, lean as a plasterer's lathe, with a cadaverous face holding an expression of permanent exasperation.

"What can I do for you?" Gus inquired. "I'm Gus Wilson."

"Listen to this motor run," the man begged. "Do you hear anything wrong with it?"

"Can't say that I do," Gus said, cocking an ear to the idling straight-eight motor. "Sounds pretty to me."

A wild look came into the driver's eyes. "That's what the cops say. But I claim that this rattletrap misses, turns handsprings under the hood and runs backward half the time."

"Cops?" Gus said. "You wouldn't be Mr. Pearson, by any chance?"

"The same," Pearson retorted. "I'm supposed to be a reckless driver."

"Are you?" Gus asked.

"No!" Pearson cried. "For years I've driven back and forth to my job in Stanfield, 80 miles a day, without a traffic ticket. Then I buy this jalopy and every time I turn around someone blows a siren down the back of my neck. I tell you, it's driving me daffy."

"Tell me about it," Gus said.

"I'm a careful driver," Pearson said, glaring around, as if to challenge somebody to dispute his claim. "But when a man drives 40 miles to work he has to move right along."

"Of course," Gus said soothingly.

"Okay," Pearson said. "So I'm moving along. Everything is fine. The car is run-

Gus eased over onto the shoulder and leaped out of the car.

ning sweet. Then I step on her a bit. And *then*—brother!"

"Misses, huh," Gus said. "But why should you be arrested for that?"

"Why should I?" Pearson jabbed a finger angrily into Gus's middle. "Now get this, Wilson. I'm in heavy traffic, see, trying to get to work on time. There's one of these crawling characters up ahead. We're all anxious to get by. Then there's an opening and the guy in front of me zooms around this slow-moving guy. There's plenty of room for me to get around, too, and maybe some of the cars behind me. So I step on it, and whish!"

"WHISH!" Gus echoed. "So you go around. I get it."

"You don't get it," Pearson declared. "I only go halfway around. Then this belly-flopping, bent-in-the-middle car of mine begins to miss bad. Now, Wilson, what would you do?"

"Flare my stop lights and ease back into line. That's the only thing to do when you start to pass and can't make it."

"Hah!" Pearson snorted in disgust. "You don't ease back slowly with a motor that's practically running backward. You ease back fast, and the cars behind whomp on their brakes. Tires screech and everybody sticks his head out and makes faces at you and calls you names, and then a cop comes along and you find yourself talking to the judge."

"I see," Gus said. "Why haven't you had the car fixed?"

"Fixed! I've had the dang thing in every garage in Stanfield. How can you fix a car that won't act up unless you're driving 50 miles an hour?" Pearson scratched his head. "Let's get back to my story . . .

"After easing back into traffic, I pull off on the shoulder and stop fast. I whip out the door, leap to the front and throw up the hood. There she is, just chuckling at me. I keep thinking that if I'm fast enough, sometime I'll catch her at it."

"And," Gus said, "you try to be so fast that a police officer calls it reckless driving."

"Exactly!" Pearson exclaimed. "And don't think one of those characters will believe it's motor trouble. They just listen to that sweet-running motor, look up and sort of sneer. That's what I tried to tell the judge this morning. I said, 'Now get this, Your Honor . . .' "

"What did the judge tell you today?"

"He pointed his finger at me," Pearson explained, "and said, 'You either prove to me that there's something wrong with your car and get it fixed, or I'm going to suspend your driver's license for 90 days, and recommend that you be sent to the county hospital for observation. You can take your car anywhere you like, but I suggest that you see Gus Wilson. This court will accept his decision.' "

"Hospital observation—good Lord!" Gus exclaimed. "We'd better get busy and see what's wrong with this car."

Gus's first guess was that the car needed a new set of spark plugs—weak plugs would short out under rapid acceleration. But he was pretty sure that, since other mechanics had worked on the car, he was up against a tougher nut than this to crack. With the uneasy feeling that Judge Morley Walker was breathing on his neck, Gus went to work.

HE CLEANED and tested the plugs, finding them all right. He checked the ignition points, and the distributor-shaft bearing for a loose bushing. He took care to see that the spring tension on the distributor breaker point was not too great, causing bounce and missing at high speeds. He removed the distributor breaker plate and checked the centrifugal weights of the automatic advance for freeness—a slow spark on acceleration would cause a loss of power. He checked the coil and condenser connections.

Turning to the fuel system, he checked the accelerating jet and pump in the carburetor. Next, suspecting stalling due to a low gas level in the carburetor bowl, he checked the float level, cleaned the carburetor, checked the gas line, gas tank cap vent and gasoline pump. He made sure that the intake-manifold studs were tight, with no air leaks.

"Let's road-test her now," he said.

"Better take a road where there's no cops," Pearson warned. "They seem to get hot under the collar every time they see this rig."

DOWN the highway toward Stanfield, with Gus driving, the car ran smoothly. When Gus found himself clear of traffic he speeded up, then fed throttle as

he would if he had been trying a fast pass. The car picked up speed—then began to miss badly and fall away in power. Gus eased over onto the shoulder, leaped out and popped open the hood. The motor now idled smoothly. After trying this maneuver several times he began to understand the look of exasperation riding in Pearson's eyes.

"Now it's got you doing it," Pearson declared. "First thing you know a cop will come along and slap you with a ticket. You should try this during the rush hours, when folks are trying to get to or from work."

"I see what you mean," Gus told him, a puzzled expression in his eyes. "If I could only get it to miss when it's standing still."

"That," said Pearson, "is just what I've been trying ever since I got the car."

The problem still seemed simple to Gus. The car acted all right when standing still, or when running steadily along the highway, but missed badly on rapid acceleration when the motor would naturally be doing considerable shaking in its rubber-cushioned hangers. There must be a raw or broken wire, or a loose connection affected by the motor shake.

GUS began a thorough search for such wiring trouble. It got him nowhere. He tried the car again anyway—and got the same overall missing and sudden loss of power. It was baffling.

Gus hated, as do all good mechanics, to open a motor wide when not under load, but he felt justified this time. He reached beneath the hood and rammed the throttle wide open. The motor leaped from idle to full power without a sign of a miss.

"Peculiar," Gus said, straightening his back. Then a wary look came into his eyes. He twisted the sleeve of his coveralls around. "That's funny, my elbow's wet. Does this car use much water?"

"No," Pearson said, "but I suppose the service-station operator adds some water every time I buy gas."

REACHING under the hood again, Gus gunned the motor to full, his eye on the radiator. As the motor shook in its rubber-cushioned mountings under full acceleration, Gus saw a thin jet of water shoot from the gooseneck of the upper hose connection.

"Ah!" he breathed, examining the point minutely. "We've got it whipped. Let's hustle back to the garage."

"What was it?" Pearson asked.

"A tricky combination," Gus told him as they drove. "There's a tiny crack in the pipe where the upper radiator hose attaches, and a very stiff upper radiator hose. This crack doesn't leak except under rapid acceleration, when water pressure is suddenly increased and the motor shakes in its hangers. Then the tiny crack opens up and throws a thin spray. It's picked up and atomized by the fan blast, and thrown on the plugs—that's when they short out. By the time you pull over, get out and raise the hood, the heat of the motor has dried off this thin film of water. We'll solder that crack, put on a more flexible upper radiator hose, and your trouble is over."

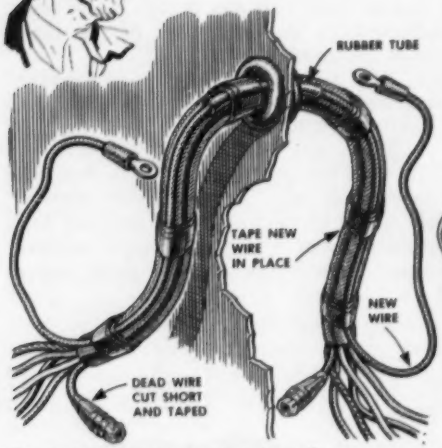
Pearson said doubtfully, "Can you make the judge believe that, Wilson?"

"He will," Gus assured him. "Don't forget, he took the trouble to look up your past clean driving record, and decided that something here needed looking into before he suspended your license."

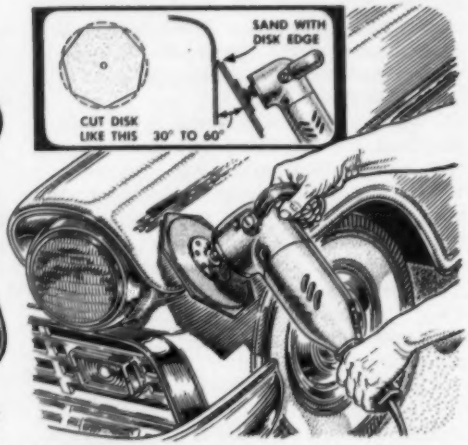
"I never thought of it in that way," Pearson said—and, for the first time, Gus saw him grin. END

NEXT MONTH: Gus beats the gun.

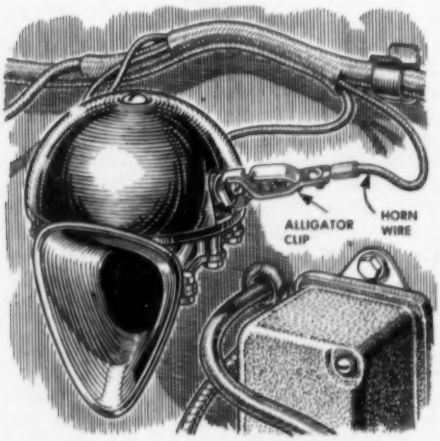
Hints from the Model Garage

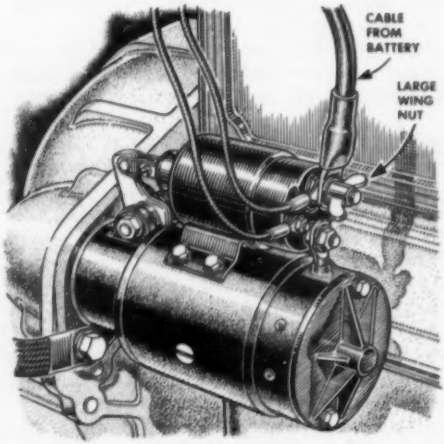


To replace a bad wire in a harness, cut both ends out of service and tape them over. Install a new wire of the same gauge by running it along the outside of the harness and taping it in place at intervals. Use rubber tubing at chafe spots.



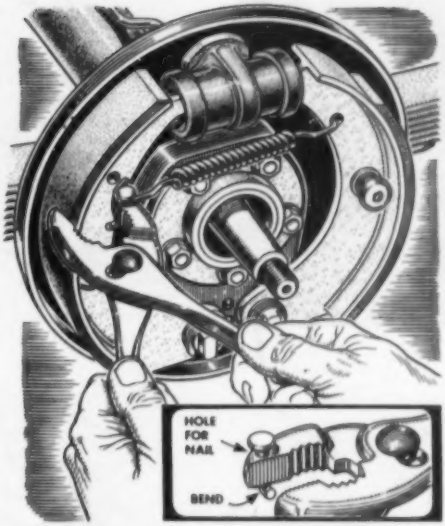
Reach into the deep spots when you clean metal for filling with lead. Worn abrasive disks, cut into polygonal shapes, will flex themselves into the recesses. Bring the tips of the spinning disk into light contact with the metal surface.



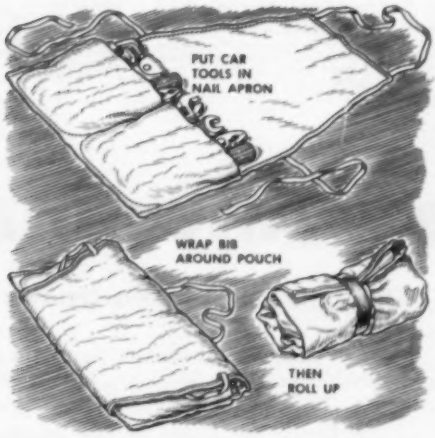


Disconnecting electrical wires fast is sometimes necessary. By having the foresight to install alligator clips on horn wires (above, left), you can yank them off immediately if the horn should stick and sound off continuously. A second tip: Fasten the battery cable to its terminal on the starter solenoid or junction box with a wing nut, as above, in place of the regular hex nut. You can now disconnect the battery in seconds, without tools, to prevent a fire in case of a short.

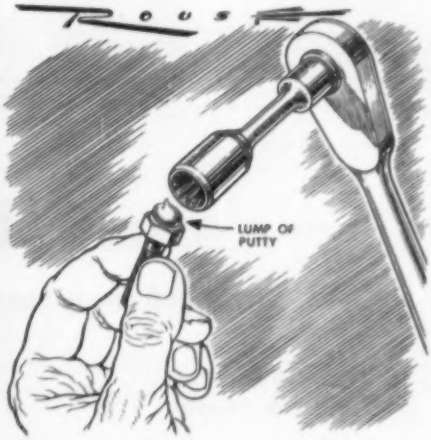
To avoid scoring valve seats when grinding-in valves, always install a lifter under the valve before beginning work. It is a constant reminder to ease up on the grinding pressure and lift the valve frequently to redistribute the compound.



Brake-shoe retracting springs can be installed with ordinary pliers fitted with a flathead nail. Hook the free end of the spring on the nail and stretch it across to the opposite shoe by squeezing the pliers against the brake lining.



Silence the rattle of tools and keep them together by stowing them in the pockets of a carpenter's nail apron. If forced to make a roadside repair or change a tire, remove the tools and slip on the apron to protect your clothes.



Stick bolts, nuts or cap screws in a socket wrench with a small lump of putty to hold them while you start them in hard-to-reach places. Leave the sticky stuff in the socket for the next hard job; it won't interfere with normal use.

PS Report: How TV Antennas Compare

DIPOLE AND REFLECTOR

GAIN: Low on all channels

DIRECTIVITY: Covers broad angle. Front is about twice as sensitive as rear on all channels. Sharp nulls on either side.

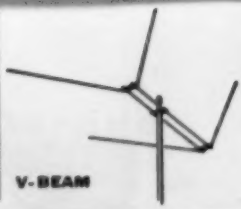
Separate antennas needed for channels 2-6 and 7-13. Since they can be aimed individually, this type is a good choice for strong-signal areas where high- and low-band stations are in different directions. The sharp nulls help eliminate ghosts.

IN-LINE

GAIN: Low on channels 2-6, moderate on channels 7-13.

DIRECTIVITY: Covers broad angle. Front is about 2½ times as sensitive as rear. Sharp nulls on either side.

One antenna covers all 13 channels. Good choice for strong-signal areas where all stations are in the same direction.



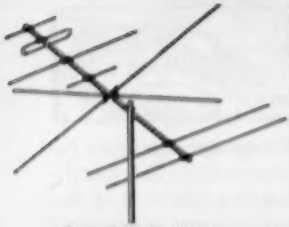
V-BEAM

GAIN: Very low on channels 2-6, moderate to high on channels 7-13.

DIRECTIVITY: Covers very broad angle. On channels 2-6 it is quite sensitive at the sides. On channels 7-13 directivity is better, but sides are still somewhat sensitive.

Bargain antennas of this type are often made too short, worsening reception on channels 2-6. Ideally, elements should each be 52 inches long, with groups of elements spaced 45 inches apart on the cross-arm.

This is a good, inexpensive antenna for strong-signal areas not bothered by ghosts, but is recommended most where the only channels available are those between 7 and 13.



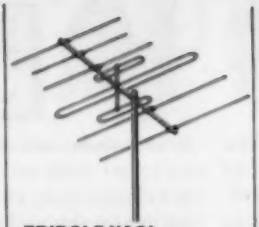
CONICAL YAGI

GAIN: Moderate on all channels.

DIRECTIVITY: Covers fairly sharp angle. On channels 2-6 front is four times as sensitive as rear. On channels 7-13, this ratio is three to one, and several angles at sides are also sensitive.

This type is better on channels 2-6 than the tripole, not quite as good on channels 7-13. Some models have a "suckout" that might affect color reception on channel 2 or 3 but would probably not be noticeable for black-and-white TV.

Trade names: Globetrotter, Big Jack.



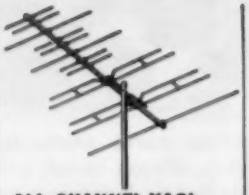
TRIPOLE YAGI

GAIN: Moderate on channels 2-6, high on channels 7-13.

DIRECTIVITY: Fairly sharp angle. Front is three times as sensitive as rear on all channels.

Performs well on all high-band channels, but best on the highest ones. This characteristic can be intensified, at the expense of performance on channels 2-6, by removing the low-band reflector and director. For greater sensitivity on all channels, more elaborate versions are available.

Trade names: Constellation, Rainbow.



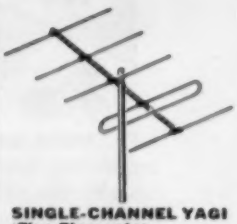
ALL-CHANNEL YAGI (Twin-Driven T-Matched Dipole)

GAIN: Moderate on channels 2-6, high on channels 7-13.

DIRECTIVITY: Sharp. Front five times as sensitive as rear on all channels.

This type performs slightly better on channels 2-6 than the previously listed yagis. Effectively blocks ghosts and interference. For greater sensitivity, more elaborate versions, such as Color 'Ceptor, are available.

Trade names: Trailblazer, Interceptor



SINGLE-CHANNEL YAGI (Five Elements)

GAIN: High.

DIRECTIVITY: Very sharp. Front five times as sensitive as rear. Sharp nulls at sides.

These antennas are built for one channel only, and separate antenna must be used for each channel you want to get. They are so sharply directional that they must be carefully aimed. Perform better on channels 2-6 than all-channel yagis listed previously.

Home and Shop

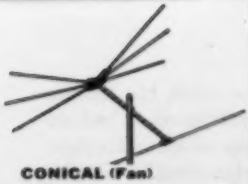
New Antennas

Which one is best? This frank comparison, type by type,

By Hubert Luckett and Martin Mann

MAYBE you're satisfied with the TV picture you get now. But it's a safe bet you won't be after you see what one of the new antennas can do. They put new-set crispness back on the screens of tired old receivers and make '57 models perform better than you ever thought possible. The right antenna can:

- Clear up the fuzzy white "snow."
- Block the faint double images of "ghosts" that haunt many city TV sets.
- Eliminate the "venetian-blind" pattern that appears when you pick up two channels at once.
- Catch channels you thought impossible to tune in.



CONICAL (Fan)

GAIN: Low on channels 2-6, moderate on channels 7-13.

DIRECTIVITY: On channels 2-6, front is 2½ times as sensitive as rear. On channels 7-13, front is twice as sensitive as rear, and several angles at side are also moderately sensitive.

This is the most widely used type of antenna. To meet price competition, many manufacturers skimp on the length of the parts (affecting reception on channel 2 or 3 particularly). Ideal dimensions are:

Outer driven elements—49 inches each, center elements a bit shorter.

Reflector bar—108 inches overall.

Spacing on crossarm—36 inches from reflector bar to point where driven element is attached.

ALL-CHANNEL TWIN-DRIVEN DIPOLE YAGI

GAIN: Low on channels 2-6, high on channels 7-13.

DIRECTIVITY: Front is three times as sensitive as rear on all channels. Several angles at side are sensitive to channels 7-13.

This type rates high mechanically. It is simple and rugged, attractive in appearance. It performs best on the higher channels.

Trade names: Trapper, Skylark.

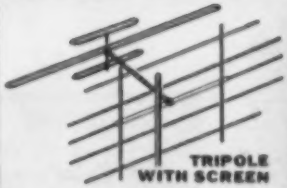
ALL-CHANNEL YAGI WITH HELIX

GAIN: Low on channels 2-6, high on channels 7-13.

DIRECTIVITY: Fairly sharp angle. Front is four times as sensitive as rear on channels 2-6, three times as sensitive on channels 7-13. Moderately sensitive to signals from several angles at sides.

This type is also available in more elaborate versions of higher sensitivity. In some models, a "suck-out" in channels 2 and 8 may cause trouble with color reception, but would probably not be noticeable with black-and-white TV.

Trade name: Star Helix.



TRIPOLE WITH SCREEN

GAIN: Moderate on channels 2-6, high on channels 7-13.

DIRECTIVITY: Covers fairly sharp angle. Front is four times as sensitive as rear on all channels. Sharp nulls on either side.

Good suburban antenna. Directivity is better than that of conical type, and gain equals that of two interconnected conicals. The screen reflector is most important—the bigger it is and the finer its mesh the better. A typical screen measures 36 by 100 inches.

Trade names: Champion, Dodo.

MULTI-CHANNEL YAGI (Two Driven Dipoles)

GAIN: High.

DIRECTIVITY: Very sharp angle. Front is seven times as sensitive as rear.

This type is made in several versions, to cover three or four adjacent channels, all of channels 7-13, or all of channels 2-6. Performance varies somewhat. Compared to single-channel, five-element yagi, the three-channel version is more sensitive, the channels 7-13 version equally sensitive, and the channels 2-6 version slightly less sensitive. All versions very effectively block interference and ghosts.

SINGLE-CHANNEL YAGI (10 Elements)

GAIN: Very high.

DIRECTIVITY: Very sharp angle. Front six times as sensitive as rear.

Separate antenna required for each channel. Can be made more sensitive by spacing the elements more widely on a longer crossarm. This yagi is the most sensitive of all commercial antennas for channels 2-6.

MULTIPLE-DRIVEN DIPOLE YAGI

GAIN: High.

DIRECTIVITY: Very sharp angle. Front 14 times as sensitive as rear.

This antenna is especially designed to block interference from TV stations you don't want. It is about as sensitive as individual single-channel, five-element yagis on channels 2-6.

Trade names: Rearguard, K.O.

TRAVELING WAVE (Seven Elements)

GAIN: Moderate to high on channels 2-6, very high on channels 7-13.

DIRECTIVITY: Very sharp angle. Front is 15 times as sensitive as rear on channels 2-6, seven times as sensitive on channels 7-13.

A compact design that covers all the channels, 2 through 13, very effectively. It is more sensitive on channels 2-6 than the all-channel yagis, and as sensitive on channels 7-13 as individual single-channel 10-element yagis. Its immunity to interference is excellent on channels 2-6 and very good on channels 7-13.

Trade name: Traveling Wave.

Boost TV Pictures

will help you choose an antenna to solve your television problems.

• Provide beautiful, full color when you install a color set.

All this from a few sticks of aluminum—not a single vacuum tube. That's because the antenna is a real working part of a television receiver. It catches faint electromagnetic waves from the air, even though their strength is only a few millionths of a volt. And it keeps out waves you don't want.

Different antennas do better at different parts of the job. Which one is right for you depends mostly on where you live. How far you are from the stations you want to receive is one consideration, but other points are important, too—the prevalence of ghosts, interference between stations, the direction of separate transmitters.

POPULAR SCIENCE's comparison chart

describes the most popular types of VHF antennas—VHF is the kind familiar to viewers of channels 2 through 13. The specs given are average figures for the type, since most types are made by many manufacturers. Not that all makes of the same type are equally good—we'll give you some tips for telling a real buy from the just-plain-cheap.

Simple antennas are widely known by type names—dipole, conical and so on. So brand names for these types are not listed. Representative brand names are given for less familiar types.

What counts. There are three clues to the quality of an antenna—gain, directivity and construction. All are important.

Gain simply tells you how efficiently the antenna catches electromagnetic waves. The higher the gain the better your set can utilize weak signals. Naturally, the farther you live from the TV transmitters, the more important gain is.

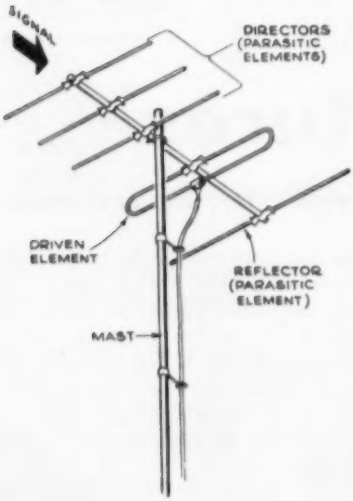
Directivity. All antennas favor signals coming at them from the front—that's why you aim them at the transmitter. The chart indicates how broad an angle they cover. A sharp angle helps eliminate ghosts, but you may need a broader angle if transmitters you want to get are in different directions.

Antennas are also sensitive, but less so, to signals arriving from the rear, and, in some cases, from other angles. Certain types are insensitive—practically blind—to signals from the side.

The chart tells how much more sensitive the front is than the rear. (The figure given is the poorest for each type; it will be better on some channels.) The higher this ratio, the more effectively the antenna can block interference and ghosts. Blind spots—nulls, the engineers call them—are even more helpful for exorcising ghosts.

Construction. Thick-walled aluminum tubing is plainly sturdier than thin stuff; and an antenna that you can unfold from its shipping carton into a rigid and complete structure is simpler to install than one that comes as a bunch of loose parts. Remember that your antenna has to stand up in all of the dirtiest weather you get.

You do need inside information to spot another price-cutting dodge. A cheap antenna, besides using lighter materials, may have shorter elements than a quality model. If the elements are seriously undersize, performance suffers. Some critical dimensions are given in the chart. These are ideal figures, and you're not



Antenna Talk

A QUICK course in conversational electronics, and you'll speak the lingo of the antenna men like a native. Here's a brief glossary:

THE MAST is the heavy piece of tubing that holds the rest of the antenna up.

ELEMENTS are the working parts of the antenna—aluminum tubing of assorted shapes and lengths.

THE DRIVEN ELEMENT is the one (there may be several) connected to your TV set by the lead-in wire. It feeds the signal to the receiver.

PARASITIC ELEMENTS bounce TV waves to the driven element. They are *not* connected by wire to the driven element or the receiver. *Directors* are mounted in front of the driven elements, *reflectors* behind.

STACKED ANTENNAS are multiple units mounted one above the other in *bays*, and interconnected.

likely to find commercial models that match all of them. But if the antenna you are checking has elements shorter by 10 or 12 inches, be cautious. Skimpy elements are less common on the more complex antennas, and practically unknown on the big jobs for fringe areas.

City antennas. Practically anything will work close to the transmitter because the TV signals are powerful. A low-gain type will usually do up to 20 miles from the transmitters.

If there is a city problem, it's ghosts. A television wave can be reflected like light off a large surface—a building, for instance. The reflected wave reaches your antenna later than the wave coming directly from the transmitter (it travels farther). So its image—the ghost—is always a little behind the direct image.

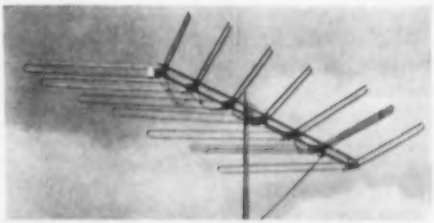
The dipole-plus-reflector antenna may cure some ghosts. It has very sharp nulls at the sides, picking up practically nothing there. If you can aim this type so that the reflected signal hits the antenna at a side, you've laid your ghost. Ghosts are not always so accommodating as to come from the side, however. For a ghost arriving nearly from the front, you may have to use a complex antenna giving high gain over a very sharp angle.

If you live more than a few miles from the TV transmitters, you may have some trouble getting channels 7 through 13. The power of their higher frequency waves drops off more sharply with distance than does the power of the waves from channels 2 through 6.

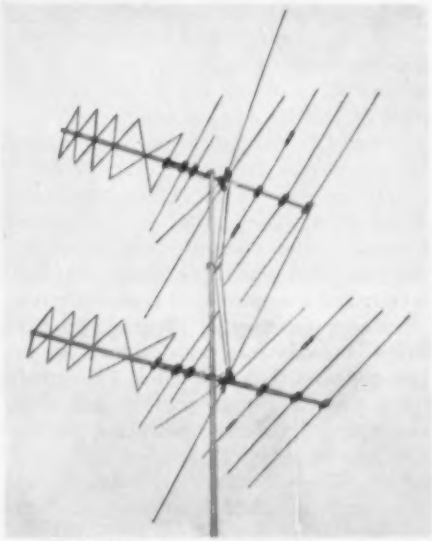
Dipoles respond equally well to both groups of channels if separate antennas are used for each frequency band. Conical types favor the higher frequencies somewhat, V-beams even more so. Both are susceptible to ghosts, however. In-line antennas are better on the high bands than dipoles, and also have ghost-eliminating nulls on the sides.

Suburban antennas. Moderate gain is generally needed if you are between 20 and 50 miles from the transmitters. But if you live between two cities, you may have another problem: TV waves from neighboring cities interfere with

WINEGARD'S COLOR 'CEPTOR, a high-performance antenna, is a more complex version of the interceptor type listed in the comparison chart.



CHANNEL MASTER'S TRAVELING WAVE is another late development for very high gain and directivity. Smaller models have fewer elements.



JFD'S STAR HELIX is "stacked" here in two "bays"—two individual antennas, one above the other, are interconnected to provide greater sensitivity for weak signals. A slightly different variation of this helix design is shown in the picture on the front cover (in the left foreground).

each other, creating a Venetian-blind pattern on the screen.

The cure, as for ghosts, is an antenna with high directivity. But since you have to aim the antenna squarely at the station you want in order to get enough signal, you can't always rely on null "blind spots" at the sides to block out the unwanted station. So an antenna that is unreceptive to signals arriving from any direction but the front is best.

Fringe-area antennas. Drive 75 miles outside a city and you begin to find homes overshadowed by tall towers that support thickets of aluminum tubing. Out here people go to a lot of trouble to see television.

High gain, to make the most out of extremely weak signals, is the first consideration. For that you can't beat the old reliable yagi—a dipole lined up with directors in front and reflectors behind—which was invented in Japan by Drs. Hidetsugu Yagi and Shintaro Uda 20 years before there were TV sets to use it on. Almost all modern fringe-area antennas are fundamentally of this type.

The trouble with the basic yagi is that you need a separate one for each channel. So engineers have recently developed new versions that can cover several channels, or all channels, while still retaining most of the basic yagi's high gain and directivity (some gain must be sacrificed when it covers more than one channel).

Another way to get high gain is by stacking—interconnecting several simple antennas that are mounted one above the other. If reception is marginal, you may have to stack a number of complex types.

Indoor antennas. Despite all the claims, nobody has yet designed an indoor antenna that will catch TV signals better than a simple rooftop job. Still, where the signals are powerful, the indoor type may be all you need for a good picture. Then its other advantages—low cost, easy installation, protection from weather—make sense.

In appearance, indoor antennas are wildly different. Yet technically they are all alike: dipoles. "Rabbit ears"—metal rods that swivel so you can aim them, and telescope so you can adjust their length to different channels—are the most popular.

There's one widely sold type of rabbit ears with a switch on the base. The switch is real but its purpose is dubious. In different positions it simply connects the antenna elements in several *wrong* ways, degrading the picture. You quickly find the one "best" switch position—actually the one correct position—and leave it set there. Then it operates as well as, but no better than, the cheaper rabbit ears without the switch.

Other fancy indoor antennas are honestly engineered. They have extra features—filters, tuning switches that really work, attractive appearance—that justify their higher cost.

How about color? You may be disappointed when you connect a color receiver to an antenna that seemed perfectly satisfactory for black-and-white. Not that color requirements are different, just stricter. Here's why.

A television signal covers a range of frequencies six megacycles wide. If your antenna misses part of that six-megacycle bandwidth, you probably won't notice it—on black-and-white. That's because the black-and-white information is spread pretty generally over the bandwidth.

Not so with color. Different parts of the color information are sent at different specific points within the bandwidth. If your antenna misses part of the bandwidth, part of the color will be missing and no fiddling with the controls can put it back—the signal just isn't there.

Some antennas actually "suck out" critical sections of the TV wave. Why? The experts disagree. One of the country's leading authorities blames suckouts on the second low-band reflector element. Another specialist, of equal repute, thinks it's the center element in the conical "fan." Both agree, however, that suckouts most often afflict channels 2 and 3, but may occur elsewhere. When you invest in color, it's wise to spend a few bucks more for a new antenna—one guaranteed to perform well with a color receiver. **END**

His Speedboat Is Built of Roofing

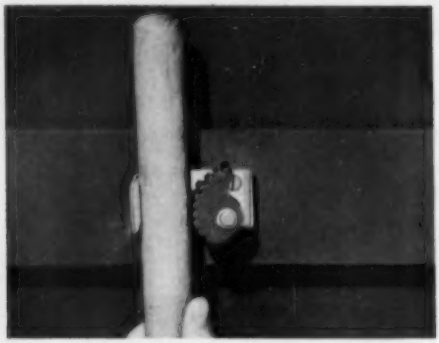
PEOPLE always turn to watch when this little outboard skims over the water of California's Napa River. Dick Johnson built it from two sheets of corrugated-aluminum roofing. The corrugations, slanted down toward the rear, help the boat plane high at top speed.

The upper edges of the boat are strengthened with 1¼" aluminum tubing, slit, slipped over the edges, and welded.

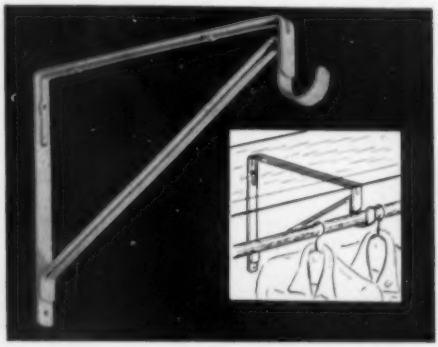
New for the Handyman

1. Grout Strips Speed Tile-Setting. Thin strips of white plastic, 1/10″ wide, eliminate the need for grout between plastic tiles, their maker says. You set the strips in mastic along with the tiles. Vertical strips, 4¼″ long, are standard tile size; horizontal strips are 18″. Corner strips have a 90° bend. Curved strips space cap tiles and base molding.

3. Hog-Ring Kit Has Uses. Long standard for securing covers to car-seat frames, these handy clips are now available with special pliers in home-size kits that ease many fastening jobs. The pliers squeeze a clip into a triangle for securing such things as a cover on an ironing board (above), upholstery on a chair, a vine to a stake or pleats in drapery.



2. Cam Holds Any Size Handle. Tools, rakes, shovels, brooms and mops can be stored against the wall, locked in place by this cam-grip holder. You insert the handle with an upward motion that opens the cam to required width; let go, and the weight of the tool locks the cam on the handle. A slight upward motion in removing the tool releases the grip.



4. Closet Bracket Doubles in Steel. Both shelf and clothes pole are supported by these new wall brackets. You can screw a 12″-wide shelf to the horizontal arm and lay a 1⅜″-diameter pole in the hooked ends. Only two brackets are needed in an average 4′ closet, but one or two additional brackets are recommended for support on wider spans.

More information *about these products can be obtained from: 1. Arterest Plastics Co., 255 W. 79th St., Chicago; 2. Bassick Co., 437 Howard Ave., Bridgeport, Conn.; 3. Republic Fastener Prod. Corp., 43-11 Crescent St., Long Island City, N.Y.; 4. McKinney Mfg. Co., 1715 Liverpool St., Pittsburgh.*

Here's a bundle of utility at a bargain price

12 All-Season Uses for Snow Fence

By William B. Eagan

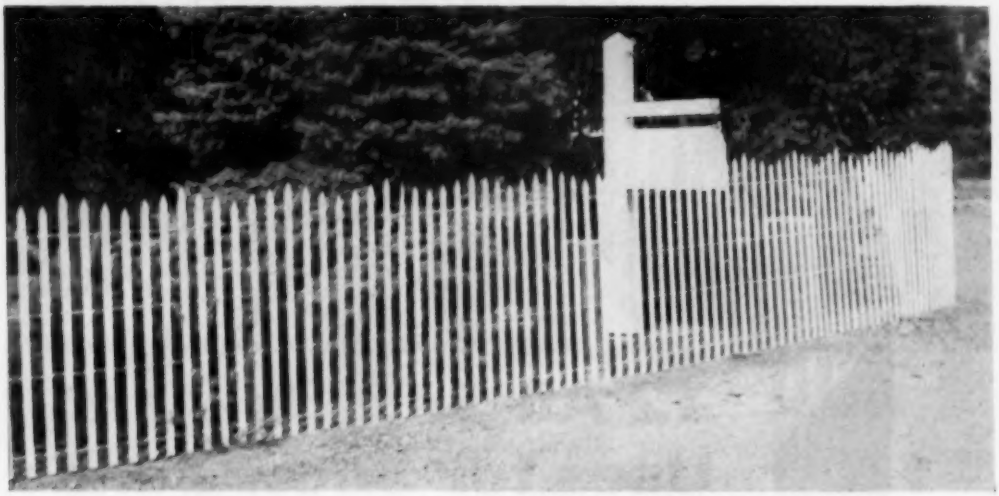
MADE to keep snow from drifting over roads, snow fence has many year-round applications besides. It comes as a roll of unplaned wood slats, ½″ thick by 1½″ wide, firmly strung 2″ apart on galvanized wire. The slats are dip-painted with red oxide, which is ample weather protection, or makes a good undercoat for any other paint you may want to apply.

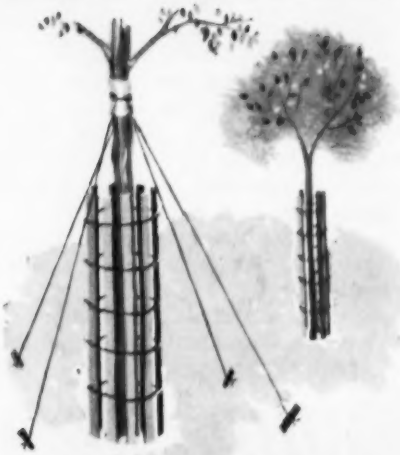
Snow fence is cheap, too. A mail-order house will sell you a 50′ roll of the 4′ height for less than $10. Shorter fence and smaller quantities may be available locally.

To cut off any length, simply snip the strands. The height can be cut down by sawing through all the slats. On this page and the following two, you'll find many useful snow-fence ideas.

1 GARDENING HOBBIES can thrive in a snow-fence shade house. Simply build a framework and nail on the fencing for roof and walls.

Versatile snow fence offers the answer to many problems .....





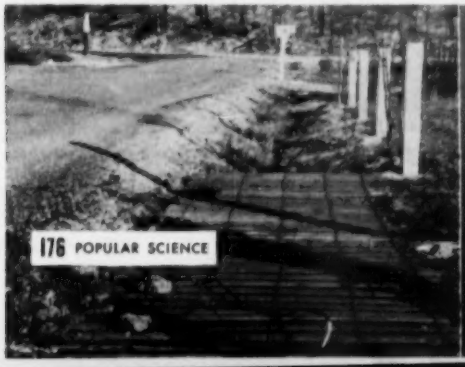
2 LOW-COST PICKET FENCE needs no in-between posts or rails for moderate lengths. Point the slats, or cut them on a wavy line.

5 A TREE GUARD can be made by tying the ends of a piece of fencing together. If it won't stand alone, tie it lightly to the trunk.

6 BABY CAN PLAY outdoors in a sizable pen made by tying 30"-high fencing in the form of a square. No extra posts are required.

9 COVERING OPEN DITCHES with fencing helps keep them free of rocks, leaves and other debris that might clog the flow of water.

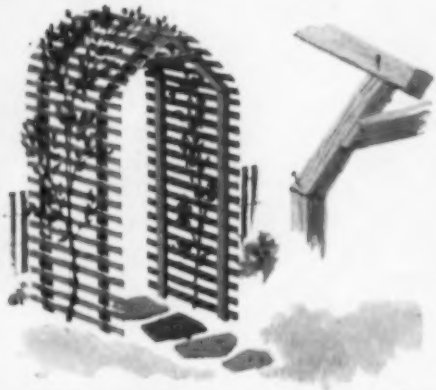
10 STUCK? Two short pieces of 2' fencing help your car get out of slick spots. The slats will give added traction in mud or snow.



3 WEIGHTED WITH FENCING like this, straw laid over newly seeded lawns or reseeded areas won't blow away to litter the grounds.

4 FIRM UP SOGGY GROUND under clotheslines and in other traveled areas. Snow-fence "duckboard" keeps feet out of mud or slush.

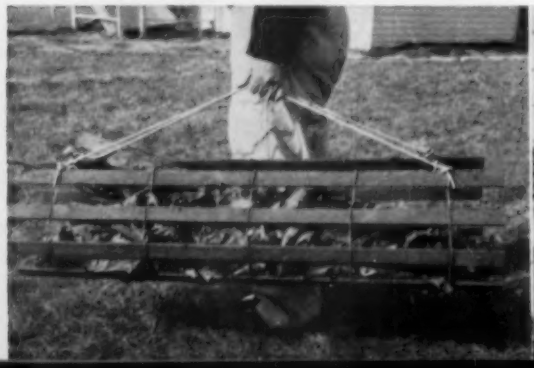
7 LAZY MAN'S LOUNGE is made from a length of fencing, ½" rope and two rings. A cot mattress or hammock cushion will add to comfort.



8 HERE'S A TRELLIS that costs little, looks like a lot. Set posts into the ground, add a gable, and drape a length of snow fencing over it.

11 HANDY CARRIER for garden trash and firewood can be made from a piece of 4' snow fence. Rope handles are tied to the ends.

12 A KING-SIZE DOORMAT to cover the whole stoop is easily cut from snow fence. It won't pack with mud like hemp or rubber. END



Planning some ground work this spring? Before you break sod, learn

The Right Way to Dig

By Carl Dreher

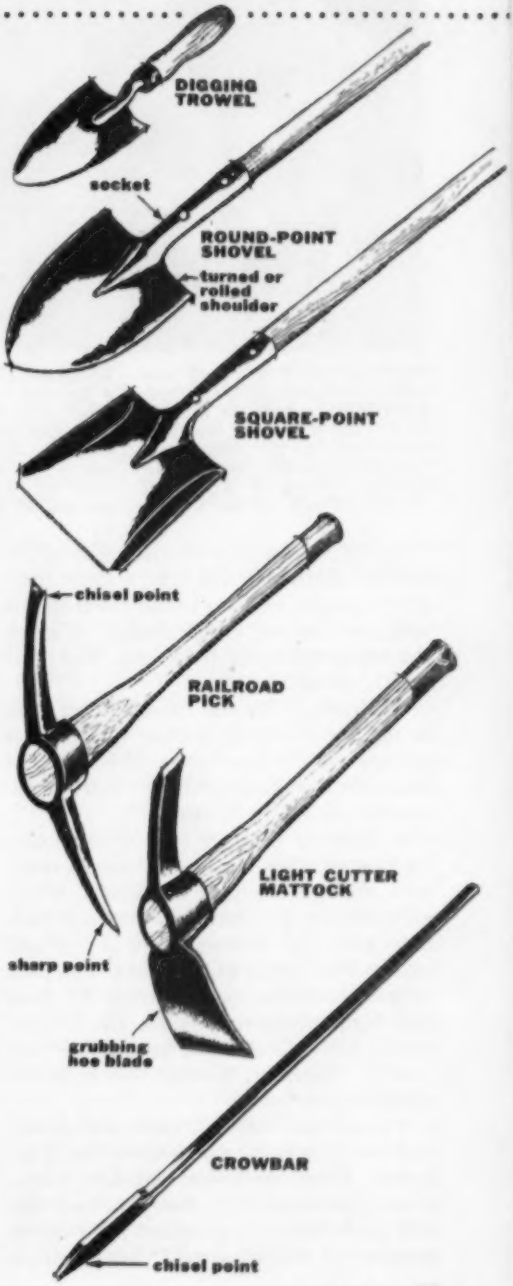
MAJOR earth-moving jobs are done nowadays by machine. But almost every homeowner falls back on the traditional pick and shovel at times. Since the technique is thousands of years old, you'd assume that everybody knows how to dig by instinct, as a dog knows how to swim. But you need only watch the average suburbanite for a few shovelfuls to be disillusioned. Digging is hard work at best. Without the know-how, it's practically impossible.

Six tools will see the average householder through all the digging jobs of a lifetime. They are:

• Round-point shovel. This is the most important of the lot—it can double as a spade—so it pays to get a light industrial type, rather than one designed specifically for the do-it-yourself market. It should have a straight handle and a No. 2 blade. This blade will be from 10¾″ to 12″ long and from 8½″ to 9½″ wide. Good modern designs have an integral blade and socket into which the handle is fitted, or front and back straps with the handle riveted between them. A recess in the back of the blade where the handle ends is undesirable—it collects dirt and complicates cleaning.

The blade should be smooth, polished, and turned or rolled at the shoulders to make a step for the shoe of the digger. Two curves, intersecting in a point, form the forepart of the blade. The ash handle is about 47″ long. A shovel meeting these specifications weighs between 4 and 5½ pounds and costs about $4.

• Square-point shovel, or scoop. This tool should have a large blade (12″ by 14″) and a straight handle. It is not used for digging, but for shoveling loose ma-



SIX DIGGING TOOLS at right will handle any excavating job that you're likely to run into.

Digging a trench? Here's how to do it

STRIP TOPSOIL from trench area with a straight-handled, round-point shovel. Begin by digging out a narrow strip the length of the trench. Follow with a succession of parallel bites, as in spading. Throw all of the soil on the far side of the trench.

BREAK UP ROCKY SUBSOIL with a railroad pick. Avoid heroics when you swing it—a steady pace gets the best results. Don't bite into more earth than you can pry loose with a quick upward lift of the pick handle at the end of each stroke.

REMOVE DIRT in successive, shallow layers. Dump subsoil on opposite side of the trench from topsoil. If the trench is to be shallow, keep dirt close to the edges for quick backfilling. If deep, leave room at the edge for the last shovelfuls of dirt.

terial such as sand or gravel. Its chief advantage is that it will take a large load. For example, where a round-point shovel will carry about eight pounds of sand, the scoop will carry 15 pounds. The cost? Again, about $4.

• Digging trowel. You'll find this handy for working in close quarters, as in uncovering an irregularly shaped stone. One with a 3½"-by-6" blade is inexpensive—about 75 cents.

• Railroad pick. A pick is necessary for loosening hard earth, dislodging boulders, and generally in breaking a working path for the shovel. Get a light railroad pick with a sharp point at one end and a chisel point at the other. The pick proper should be approximately 23" long and weigh about six pounds. The 3' hickory handle will account for another two pounds. Together, the cost will be in the neighborhood of $4.

• Mattock. This is a most useful tool and an old one—it came over on the Mayflower. There are several modern variations (see page 181). But your best bet will probably be a standard light cutter mattock. It will have a 13" head, with a 3"-wide grubbing hoe blade at right angles to the plane of swing. At the other end is a cutter blade set in the plane of swing. The more common cutter mattock has a handle like that of a pick—the eye in the mattock head is slipped over its full length to a wedge-fit at its working end. A mattock can often be used in place of a pick, to break up subsoil. But its most useful purpose is to clear out root-choked soil. It will cost about $3.50.

• Crowbar. This hefty steel bar with a chisel point is used to move boulders. It is also handy for breaking up ground in small but deep holes where a pick would be useless (fence-post holes, for example). Crowbar weights range from 10 to over 20 pounds, and lengths from 4' to 5½'. A 16-pound bar, at $6, is a good choice.

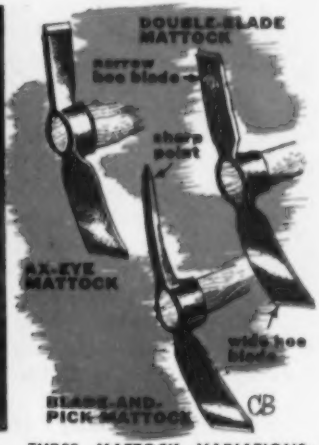
Digging and shoveling are related but separate operations. Digging is essentially cutting; shoveling removes what is cut. In loose material, such as sand, there is no cutting problem. In compacted soil there is.

When digging, you go through a series of movements that sound complicated

Clearing root-choked soil? Use a mattock

CUTTER MATTOCK is best for this job. Keep the cutting blade sharp with frequent filing or grinding, and use it like an ax, as shown here, to sever roots. Plant feet well apart when swinging; the tool may hit an unseen stone and glance off.

USE GRUBBING BLADE for stripping sod, ripping out clumps of roots, and skimming soil to rough grade. It's also handy for breaking up clay subsoil that is fairly free of rocks. There, its broad, heavy blade does a faster job than a pick will do.



THREE MATTOCK VARIATIONS: Used mainly by foresters, the ax-eye mattock is designed to take a conventional ax handle. The blade-and-pick mattock and the double-blade mattock are used both as surface-stripping and subsoil-digging tools.

but quickly become second nature. Place the point of the shovel on the surface and push it into the ground with the left foot (assuming you are right-handed). At the same time assist with both hands, the left about halfway down the handle, the right at the upper end. The right foot should be well back to give you a firm stance.

When the blade has penetrated as far as it will go, remove the left foot and place it on the ground near the blade. Move the left hand down the handle near the blade. Bend the left knee but don't bend your back more than you can help. Then, using the left hand as a pivot, or fulcrum, rotate the shovel with the right hand and lift the load. Don't try to lift with both hands far from the blade. If you do, the leverage is against you and you'll tire fast.

If you want to dig long, don't dig fast. Pace yourself like a mile runner, but not for a sprint at the end. Your reserve is margin against overexertion.

Even a small stone under the shovel blade can stop it from penetrating. Wiggle the shovel and if the obstruction is small you may get by it. Or try again a few inches away. If you're still blocked, resort to the pick.

The pick is used, not only to loosen the earth and enclosed stones, but as a prying tool to dislodge moderately large stones. Don't use the shovel for this purpose. Ash is a very strong wood, but the handle will break. Hickory is even stronger than ash, and the hickory pick handle is short and thick.

For really authoritative leverage, the crowbar is your best bet. With a 22-pound crowbar, using a relatively small movable stone as a fulcrum, it is possible to shift even a one-yard boulder (about 2½ tons, as compared to 1¾ tons for a medium-size passenger automobile).

Care of digging tools is important. After use, tools should be washed clean under a hose outlet, wiped dry and kept in a dry place. A bit of rust does little harm but, in general, the cleaner the tools, the easier the digging.

The blade of a shovel should be kept sharp, as with any cutting tool. It can be sharpened on an electric grindstone with a 6″ abrasive wheel, but the handle gets

in the way. For that reason you may prefer to sharpen the blade by hand. You can do this best with a 12" or 14" coarse or medium-coarse double-cut flat file. Sharpen one side only. The lower, or convex side is easiest, but if there is already a bevel on the concave side, sharpen that.

To hold the shovel firmly while you work, rest the blade on the edge of the workbench, with the end of the handle resting on the floor. Twist one leg about the handle and push the other knee against it. Or clamp it in a fairly large vise. When filing, take long strokes toward the cutting edge of the blade only.

Boulder in your way? Here's how to move it .....

TO BOOST A BOULDER out of the ground, dig a hole around it and shovel a ramp up one side. Crowbar the boulder up the ramp, using small stones to hold what you gain on each lift.

BURY THE BIG ONES, by digging holes beside them and levering the boulders in. If possible, place such holes so that the boulders can be rolled in side-over-side, not end-over-end.

The important sharpening is toward the midpoint. The bevel should increase from about 1/16" at the sides to 3/16" in the middle. The blade should feel sharp, but there's no use trying to put a razor edge on a shovel.

Mattock steel is harder than shovel steel and, since the handle is removable, the blades are easily sharpened on an electric grinder. Retain the original bevels and dip the blades in water to avoid overheating. A file can be used to sharpen a mattock if a grinder isn't available.

A bent shovel blade may be straightened on an anvil with a hammer. A split or broken handle on a shovel or any other tool should not be repaired, but replaced, if feasible. Hardware stores carry and install replacement handles.

Watch your step. Digging tools are not dangerous when properly used. But the forces involved are considerable and you have to exercise reasonable care. You can injure yourself with these tools, even without using them. The usual helter-skelter arrangement, leaning up against a garage wall, may result in a bloody nose when someone steps on a rake, or pulling out one tool may bring down another on your feet. Hanging the tools from 12-penny nails in pairs saves floor space, looks better and helps avoid accidents. Crowbars are best laid flat on the floor.

Carry a crowbar at the balance point near the heavy end, and use it with special care. Look back of you before you swing a pick, and don't swing too enthusiastically. Finally, stop before you get dog-tired, even if you aren't in the upper age brackets. END

Replacing a broken windowpane is a common job around any home. But you don't have to call in an expert. You can do the job yourself.

On the following two pages you'll find a reference sheet, designed for easy saving, that will help you do it. This is one of a series of monthly home-repair guidance sheets appearing in POPULAR SCIENCE.

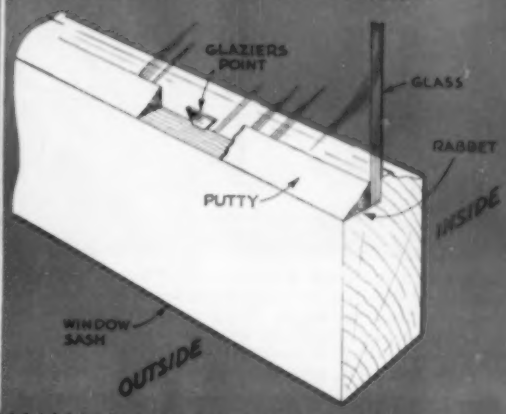
Next Month: Lamp-cord repairs.

Popular Science Fix-It File

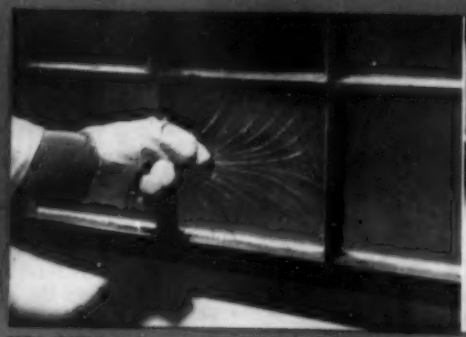
WINDOW GLASS

WHAT YOU NEED

THE PARTS OF A TYPICAL SASH

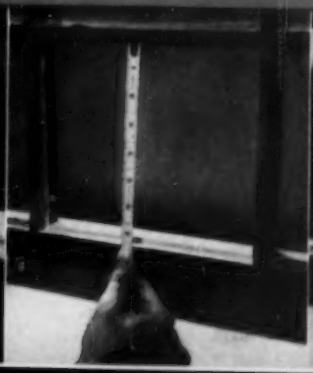


1 *How to remove old glass, fit the new*

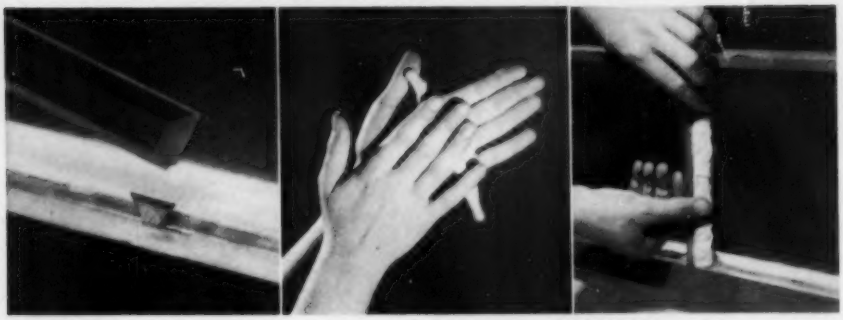


PULL OUT LOOSE GLASS, wearing gloves (if you have them handy) to guard against cuts. To remove old putty that doesn't break out in chunks, use a wood chisel or perhaps a knife. Don't try to pry the putty free. Cut it away, being careful not to gouge into the wood.

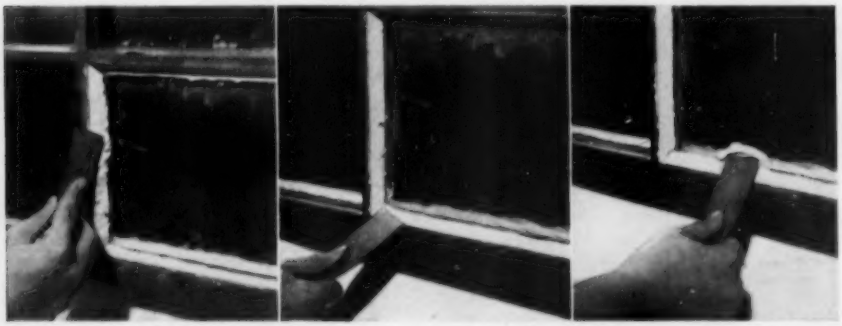
CLEAN OUT THE RABBET THOROUGHLY, prying out all the old glazier's points and scraping away every tiny bit of putty that may cause new glass to break when pressed in. Measure the opening, as in the center picture below, and subtract 1/16" from the height and width. A new pane should always slip in loosely, never be tight. Buy single-strength glass for small panes, double-strength for large panes. Before setting the new pane in place, it's advisable to coat the rabbet with linseed oil. Sometimes a glazier may also apply a very thin coating of putty to the back face of the rabbet as a smooth bed, and a tight seal, for the glass.



2 How to set the points, apply the putty

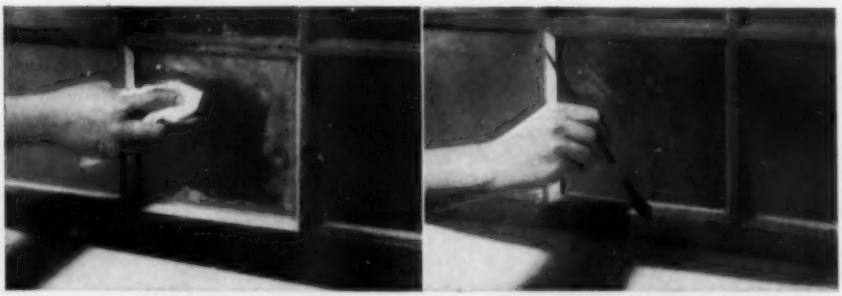


FOR A GOOD GLAZING JOB, set at least two points into the frame along each edge of the glass, more for large panes. Press points flat against glass and tap them into the wood with the side edge of a chisel, sliding the tool over the glass with short strokes. Or use the special driver that sometimes comes with glazier's points. Leave 3/16" of each point protruding. When the glass is set, roll putty between hands, shaping into pencil-size strips. Press strips firmly into the rabbet; distribute them evenly with the fingers.



TO BEVEL THE PUTTY, press the knife into a corner and draw it along with a firm, quick stroke (left photo). Hold the knife nearly flat so that it slides over the putty. After the first pass, look through the glass from the other side to see if putty is higher than the vertical side of the rabbet. If it is, press it down with another pass of the knife. After smoothing the four sides, press corners into a neat miter (center) and clean away the excess putty (photo at right) that was squeezed out from under the knife.

3 How to clean glass, paint the sash



TO WIND UP JOB, clean the glass with a turpentine-moistened cloth. If you have used standard putty, delay painting until its surface has hardened. Glazing compound may stay pliable indefinitely. Apply paint with a small brush. Paint will help seal the window if you let it lap over the putty onto the glass. Finally, scrape off any excess paint. END

I learned about this job the hard way. To avoid my mistakes, you ought to learn how a pro goes about—

Repacking Your Car's Front-Wheel Bearings

By John O. Bock

THE day I drove into Earl's service garage last fall I almost clipped Earl himself. My brakes didn't hold, and Earl jumped just in time.

"Trying to flatten me?" he shouted.

"Trouble with my brakes," I said.

Jacking up the car, Earl knocked the chrome hubcap from one of the front wheels and pried the dust cap off the end of the spindle.

"Been doing your own work again, I see," he said, holding up the dust cap.

I looked and saw that it was very well filled with grease.

"Well, yes," I admitted reluctantly. "I did grease the front-wheel bearings the other day. I *like* doing little jobs like that. But I never touched the brakes."

Earl had pulled the cotter pin and was putting a wrench to the wheel nut. He winced. "What were you trying to do? Keep these wheels from turning?"

"Well, I wanted to make doubly sure the nut wouldn't come off," I replied.

"Funny," Earl said. "I thought that's what the cotter pin is for."

He had the wheel off now and was reaching inside the hub. He brought forth a nice blob of expensive grease which I had patiently packed into the wheel hub.

"I used lots of it to make sure the bearings wouldn't run dry," I explained.

"Uh-huh," Earl grunted. "And you also made sure the brake linings wouldn't run dry. They're soaked with grease. That's why your brakes won't hold."

"Oh, is that all?" I said, relieved.

"That's all," Earl said. "Nothing that a 20-buck relining job won't fix."

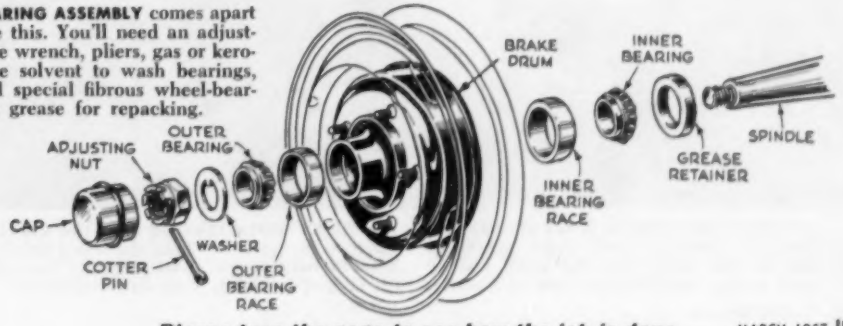
I whistled—and started thinking. I finally figured out that if I wanted to try such maintenance jobs I ought to know how to do them right. So I asked Earl if I could stand by, with my camera, the next time he was going to repack front-wheel bearings—a chore, incidentally, that ought to be done each 10,000 miles.

The series of pictures on the following two pages won't make you an expert. But at least they'll steer you away from the mistakes I made.

Should you do the job at home? That's another question. In most good shops it won't set you back more than a buck and a half. And they furnish the special grease you'd need.

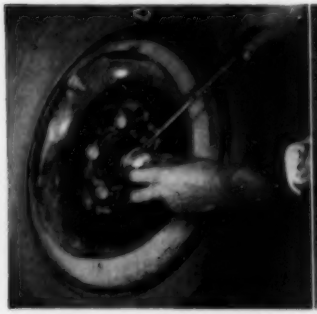
But maybe you, like me, just like to fool around a car. A lot of us guys really are crazy that way.

BEARING ASSEMBLY comes apart like this. You'll need an adjustable wrench, pliers, gas or kerosene solvent to wash bearings, and special fibrous wheel-bearing grease for repacking.

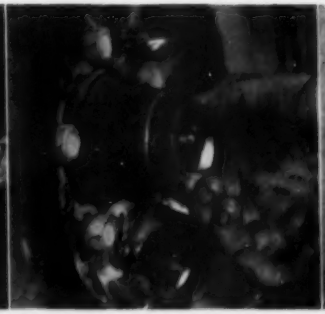


Please turn the page to see how the job is done

How a professional repacks front-wheel bearings



1. PRY OFF THE GREASE CAP after jacking up the car and removing the wheel disk. Tap the cap on the side if it's stubborn. Then remove the cotter pin and nut beneath the cap.

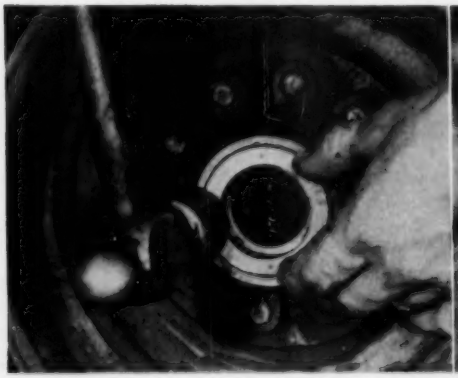


2. SLIDE WASHER OFF the spindle and remove the outer bearing. Then pull the wheel outward, while supporting its weight to keep the inner bearing from dragging over the spindle.

3. WIPE OFF DIRT around the hub of the wheel and brush brake-lining dust out of the drum. Cleanliness is important from here on; one speck of grit can chew up a bearing.

7. WORK WHEEL-BEARING GREASE well into the bearings. Pack it into the spaces between the rollers from inside and outside. Wash your hands before starting to pack bearings.

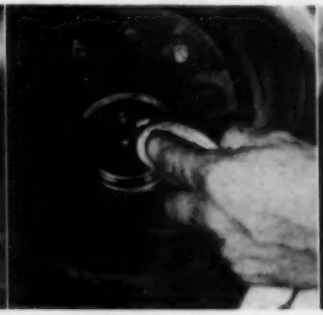
8. EXAMINE GREASE RETAINER and try its fit on the spindle. If it's loose or worn, replace it. The retainer should be soaked in light oil for a half-hour before you install it.



9. TAP GREASE RETAINER IN PLACE after installing the inner bearing. Both inner and outer bearings fit into hubs with the small end of the taper inside, like putting a cork in a bottle.

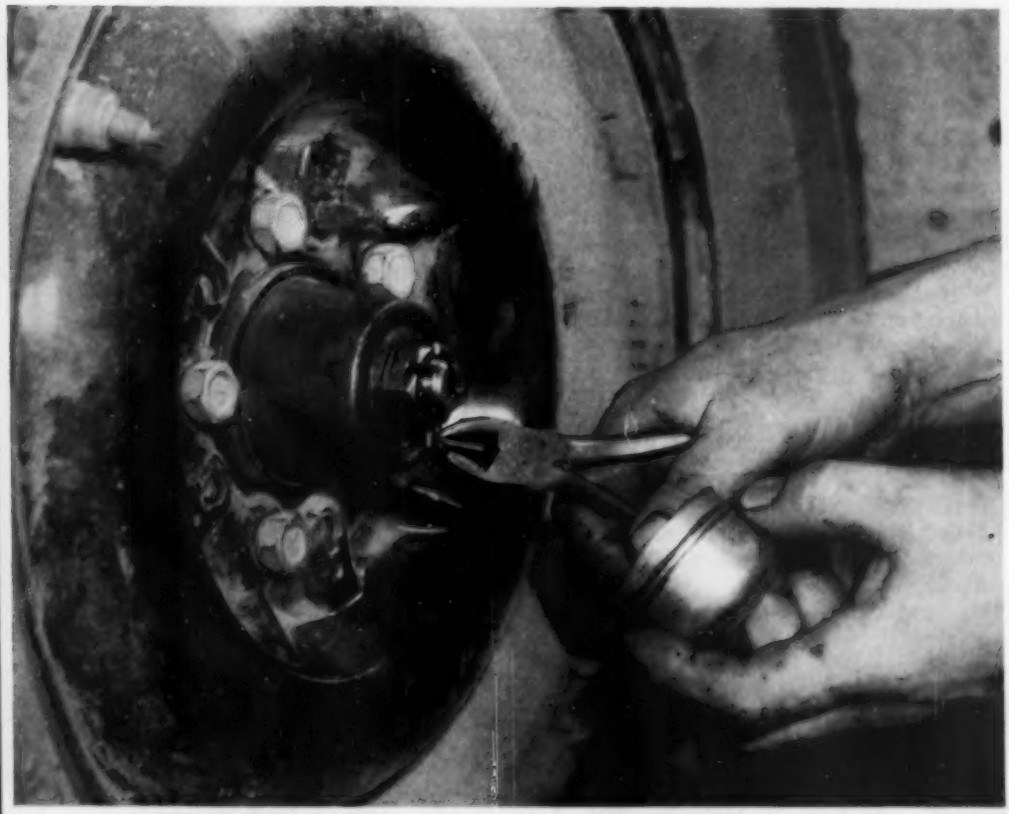
10. INSERT OUTER BEARING with the wheel in place on the spindle. Shake the wheel gently to help the bearing seat itself properly; then slide the tanged washer in place on the spindle.

4. REACH IN THROUGH HUB with a dowel and tap the grease retainer out of its seat. The inner bearing will drop out with it, so place a rag on the floor to catch the bearing and keep it clean.



5. WIPE OLD GREASE out of the hub. Then, with a fresh rag, clean the bearing races in the hub and on the spindle. Don't grease these; excess grease may run to the brake lining.

6. WASH BEARINGS in gas or kerosene. Rotate each roller in the solvent and flush out all of the old grease. If rollers are rough or chipped, replace the bearing with a new one.



11. ADJUST WHEEL BEARINGS. Tighten spindle nut while rotating the wheel until you feel it drag. Continue turning wheel while you *back off* the nut just enough to line up the spindle's cotter-pin hole with the nearest nut slot that will let the wheel turn freely without end play. Insert a *new* cotter pin and spread the ends over. Wash the grease cap and install it. END

How to Double Your

Why settle for so much less than the value you pay for? Good drivers these days get 30,000 miles or more from their tires.

By Ed Fales and Joseph Kuebler

IT COMES as a shock when a friend boasts of running a set of tires 30,000 miles if you're the common sort of driver who gets 12,000 to 18,000. Yet, today, among salesmen and other hard drivers, 30,000 is fairly common. Some get 40,000. A few *slower* drivers actually push 50,000.

Your chances of rising into the top-mileage class are best if you pile up mileage fast while the tires are still fresh, say in the first 12 to 16 months of their life. Time and atmospheric conditions always take a toll.

New facts are being discovered about tires every day. These will help you boost your mileage. For instance, did you know:

- That some experts now say it's just as important to warm up your tires as it is your engine?
- That nosing a tubeless tire too hard against a curb can flatten it?
- That some of us drivers, even the most careful ones, actually waste our spares by not switching all tires frequently?

A warmup period, some engineers claim, is advisable because of today's speeds. It is more urgent for the new 14-inch tires. Because of their lesser circumference, the 14-inchers spin faster (about ¼ million more turns in 10,000 miles) than 15-inchers. Only new cars using 15-inchers this year are Buick, Packard, Studebaker and Nash.

Cold cords don't flex together as well as warm cords. Hence warmup proponents advise:

"Don't jump in your car after breakfast and push right up to 50 or 60. This knocks off miles of wear. On very cold, sub-zero days, unwarmed treads may even chip off."

One tester urges an hour's warmup at

5 Tire-Mileage Robbers

WHETHER you'll get all the mileage that's built into tires depends to a large extent on your own actions while you're in the driver's seat.

You, and you alone, have control over the following five mileage robbers:

High speeds. At 70 m.p.h., your tires are wearing nearly twice as fast as at 45, and you can't expect to get either tire economy—or fuel economy—if you travel constantly in the high brackets. It's best to stay around 50-55 m.p.h.

Jackrabbit starts. Avoid these for the same reasons that you avoid . . .

Quick stops. One tire tester says a locked-wheel skidding stop can cost up to a third of the life of your tires, or between $20 and $70, depending on what you paid for them. The long streak you leave in the road is molten rubber.

Tire Mileage

40. Since you aren't likely to do this, he says *any* warmup time is valuable before you hit turnpike speeds.

Watch those curbs! Some repairmen say curbstones are the *chief* cause of tire failure today. "I haven't seen a blowout in three months," says one. "But we keep fixing tires that bumped the curb too hard. This breaks a few cords—and the break spreads."

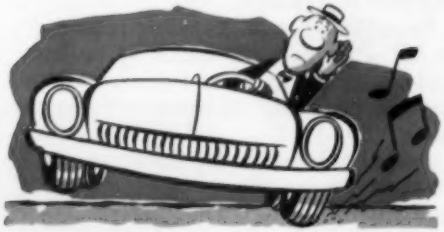
Leaving a car parked diagonally, with the curb digging deep into a tubeless tire, has been known to force the bead away from the rim and let all the air out. Another *main* cause of tubeless failure is driving on and off the edge of the road at high speed. If your dog has to get out, slow down before you drive off the pavement!

THE fellows who get top mileage are drivers who pamper their tires right from the start. Follow these five rules:

1. Check air pressure every day for one week after you put on new tires. A tire tends to expand during this initial period, losing pressure. Don't rely on gas-station gauges; keep an accurate gauge in your car.

2. Break in your tires at new-car

That You Should Avoid



Tire squeal. This is the voice of a suffering, vibrating tread. It vibrates under jackrabbit starts, underinflation and fast turns. Squeals may cost from a few cents to a dollar in abraded or melted rubber or damaged cords.

Fast cornering. This knocks life out of treads and, some experts think, can even let air out of tubeless tires.

Your tires like to be pampered when they're young

THE TREATMENT your tires get in their first 5,000 miles has a lot to do with their life span. Another help: Add a *little* more air than the tire manufacturer suggests.

speeds (100 miles at 40 m.p.h., then 500 at 50 m.p.h.) The cords must learn to mesh and flex together before you pour on the punishment. Detroit test drivers say tires last longer if they get through the first 5,000 miles without abuse.

3. Have your garageman mount tubeless tires under sterile conditions. Sand or dirt as thin as a cigarette paper between bead and rim will let air out. Some state-police garages spread huge sheets of clean paper on the floor before mounting tubeless tires.

4. Get your wheels balanced. "We can bring in 100 cars and find 80 with unbalanced tires," one dealer says. "Some come from the factory that way." If your tire is unbalanced, the heavy side slams the road like a triphammer and a flat spot results. To see where counterweights should be put, some garages merely hang your wheel on a bubble-balance. Others don't think this static balance is enough. They spin your tires at 80-90 m.p.h. on dynamic-balance testers.

5. Watch front-wheel alignment like a hawk—especially in a new car. Bad alignment can ruin new tires in two weeks.

AFTER your tires are properly broken in, here is how you can begin to stretch out the miles:

Rotate five tires, not four. Rotate every 2,000 miles for the first 10,000. If you're like a lot of drivers who change oil every 2,000 miles, a good rule of thumb is: Rotate new tires every time your oil is changed. After 10,000 miles, rotate at 5,000-mile intervals.

For long trips, load level. One test crew drove a trunk-heavy car from New York to Florida and back on new tires—and wore off nearly two thirds of the rear treads. The same damage occurs on overloaded vacation cars. To keep a heavy load level, use a roof rack.

If you lug heavy furniture for your wife, add five to 10 pounds of air.

Check air pressure twice a month. Underinflation is murder. So is overinflation. But it's okay, tire men say, to use two to six more pounds of air than recommended. Your ride won't be as soft, but your tires wear longer.

Never bleed tires. Bleeding is letting air out when pressure builds up on hot roads. A tire is built to take the extra pressure. Bleeding makes it run even hotter.

Avoid hot-weather driving if you can. Heat may cause the tread to separate from the cord plies. On hot days do your trip driving before 10 a.m. or after four p.m. if possible. (A 30-degree drop in road temperature saves you lots of tire mileage.)

Run them round. Out-of-round tires—and no tire is perfectly round—wear unevenly. One way to round them is to

switch them to the rear wheels, which drive with a sandpapering effect that wears the tires evenly.

Check for punctures. With today's tubeless tires, you can have a puncture without knowing it; the tire seals itself. But keep a careful watch for small nails and other fragments that may become imbedded. Left in, they'll gradually injure the tire.

POOR wheel alignment is the worst thief of tire life. A wheel that toes in or out ⅛″ too much scrapes sidewise 30 feet in every mile. Keep your alignment top-notch, not only at the beginning but at all times. You should have it checked at least every 10,000 miles—and rechecked immediately when you suspect that rough roads, or a severe jar (or fighting deep snow) may have thrown it off.

Check a new car more often. Dealers say many new cars toe in too much, won't hold an alignment until the frame gets its own "sag" or "set."

If you live in high-crown-road country, some garagemen say, you should have your wheels aligned especially for the high crown. They set the right-wheel camber (vertical axis) at zero (wheel straight up and down) or a bit negative (wheel tilted slightly inward instead of outward). They set the left wheel slightly more positive (wheel tilted out) than normal.

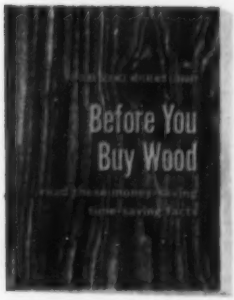
One alignment specialist guarantees alignment to last a year, if you do these three things:

- Keep 28 pounds of air all around in 14″ or 15″ tires; 30 pounds all around in 16″ tires.
- Make sure the steering gear is adjusted so the "high spot" (point of minimum drag) is kept exactly centered.
- Have all front-end and steering elements—even the housing—thoroughly tight and adjusted before alignment.

"This works well on either high-crown or flat roads," this specialist says. "Your alignment will hold for 20,000 miles. But the main secret is using 28 or 30 pounds of air instead of the 22 to 26 pounds generally recommended."

To tell if your front end needs *tightening* before alignment: Drive on a flat road, then on a narrow, high-crown road, then on a broken, bumpy pavement. If you can drive all three without any drag on the steering wheel, you're ready for alignment. If not, you need a tightening job first. Some garages pay no attention to front-end tightening, and as a result your alignment job goes out the first time you hit a bump. END

COMING NEXT MONTH: **A Booklet to Help You Buy and Use Wood**



WHY doesn't a two-by-four measure 2″ by 4″? How can you pick a wood that won't split, one that won't rot, one that will take a good finish?

You'll find the answers to these and many other questions in the April issue of POPULAR SCIENCE—in a handy, fact-filled booklet about wood that you can save for easy reference. Sixteen pages with plenty of charts and pictures will tell you how to recognize lumber grades, how to buy by the "board foot," how to choose lumber, moldings and plywoods for dozens of jobs.

Future issues of PS will carry more bonus booklets on other subjects, each one complete and self-contained. Get the first one next month to start your collection of the new **Popular Science Reference Library.**

New for Your Car

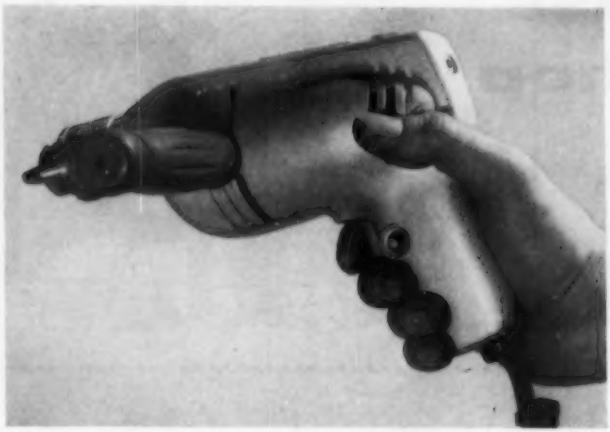
1. Spare Tire Folds Up. A new kit consisting of a deflated spare (actually a heavy, treaded tube, shown folded, above), a tire tool and a CO_2 cartridge makes it easier to cope with a flat tire. You break the bead of the flat with the tool, forcing it off the wheel by screw action instead of muscle power. The spare, which can be used and re-used for some 1,000 miles, is then slipped on the wheel and inflated with the CO_2 cartridge. When convenient, you get the old tire repaired and the cartridge recharged, and stow cartridge and spare for future need. If it replaces the standard spare, it may lead to low trunk lines.

2. Jack Works Like Garage Model. Eliminating bumper strain and the high raise necessary with a bumper jack, this jack hoists a car from the side by its frame. The jack handle, which doubles as a lug wrench and tire tool, is operated by one foot to raise or lower the car.

3. Swivel Light Sticks On. The magnetic base of this trouble light can be placed anywhere on a car's body or engine. A double ball-joint arm permits aiming the light in any direction. The 15′ line plugs into the cigarette-lighter socket. It uses a six- or 12-volt bulb.

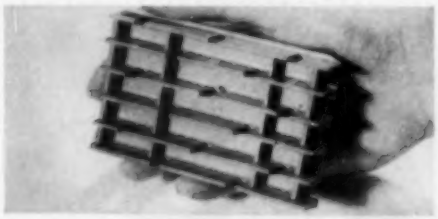
More information *about these new car products can be obtained from: 1. Gates Rubber Co., 999 S. Broadway, Denver 17; 2. Walker Mfg. Co., 1201 Michigan Blvd., Racine, Wis.; 3. Gloy's Import Co., Inc., 11 Addison St., Larchmont, N.Y.*

New Tools

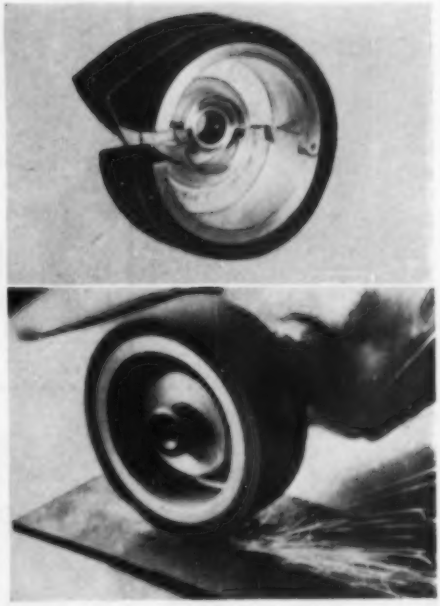


1. Low-Cost 3/8" Drill. Big news about this drill is a $26.95 price tag. Its 3/8" Jacobs chuck is driven by a two-amp. motor geared down to 1,000 r.p.m. for holes up to 3/8" in steel or 3/4" in wood. Its high-torque output is controlled by an auxiliary handle attachable to either side. Low speed lets you drill metal, concrete, marble or stone without burning up a carbon-steel bit.

2. Magnifier Sticks on Tools. A six-power lens in this magnifier blows up fine calibrations for easy reading. Built-in magnets hold it to any ferrous gauge, caliper or rule. You can use the glass also for close inspection of parts.



3. Graining Tool Refinishes Furniture. With this rubber scraping tool you can put a grained finish on old or new furniture. It is available in a kit with a new paint that comes in nine colors and can be applied over old painted or varnished surfaces or on unfinished pieces.

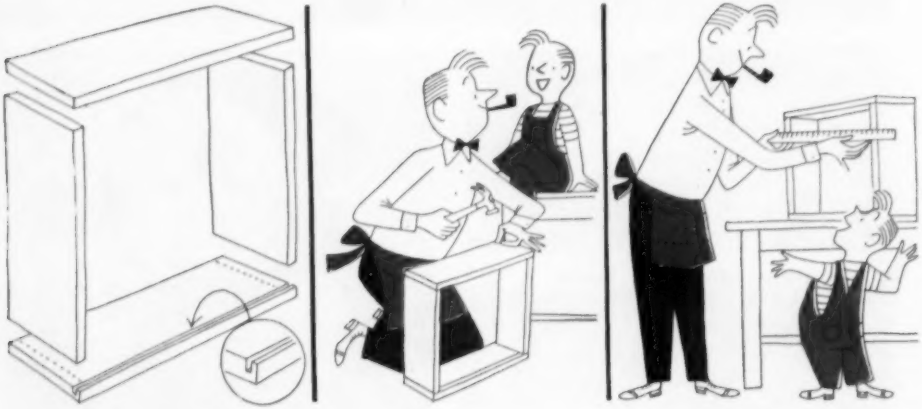


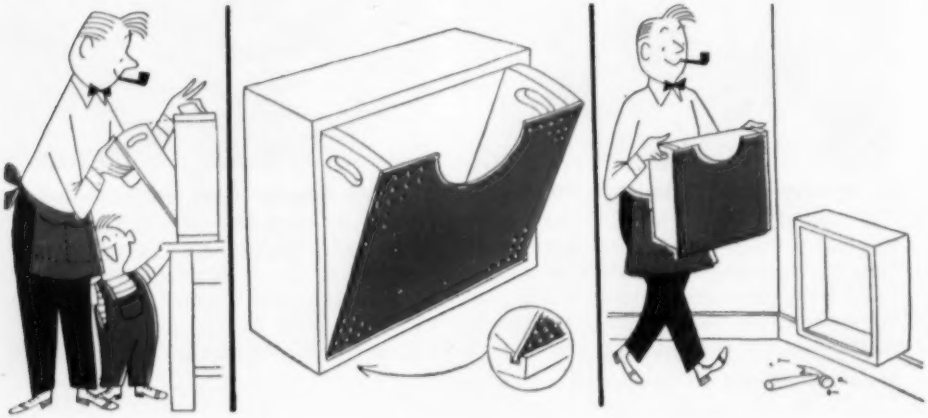
4. Drum Sander Uses Strip Abrasive. Hinged on one side, this drum sander splits in half for quick replacement of abrasive strips. A cone-shaped locking washer forces the tapered hub together when you draw the arbor nut tight, closing the halves as securely as a solid wheel.

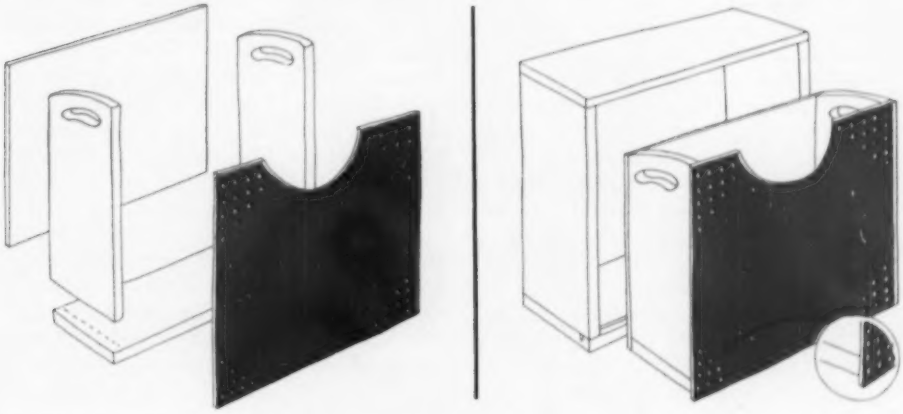
More information *about these new tools can be obtained from: 1. Wen Products, Inc., 5804 Northwest Hwy., Chicago 31; 2. Magnaglass Mfg. Co., Inc., Fredonia, N.Y.; 3. North Star Paint and Varnish Co., 612 Vandalia St., St. Paul 14, Minn.; 4. American Diamond Saw Sales, 120 N.W. Ninth Ave., Portland 9, Ore.*

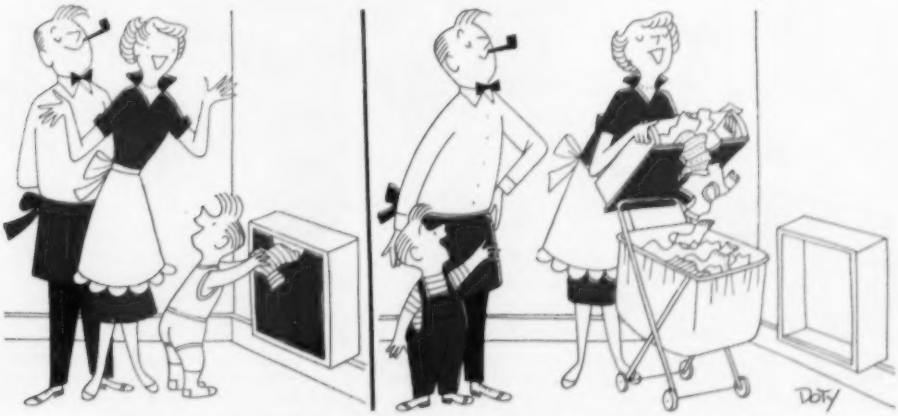
Wordless Workshop

By Roy Doty
and Bob Gilmore









Next Month: A quickly made hutch for a homeless Easter bunny

I Tuned My Speaker with a Test Record

The new Popular Science disc shows how to get wide-range response from bass-reflex units.

By William Wendt

THE first time I played the POPULAR SCIENCE Hi-Fi Test Record was just for curiosity. Further playings told me some annoying facts about my hi-fi rig—and then showed me what to do about them.

My system was a collection of unhoused parts, which I had meant to mount in a two-door cabinet to please my wife. But the cabinet was too small for anything except a bass-reflex speaker enclosure, a type I considered a boombox. All the homemade ones I'd heard belted out a lot of artificial bass never written into the music.

The instructions said my new test record could be used to tune a reflex enclosure. I built one of ¾" plywood, small enough to fit into the cabinet.

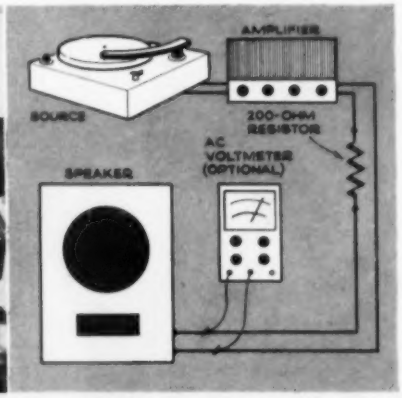
All corners were braced, joints glued to prevent air leakage, and cleats installed for seating the back panel. The bottom, one side and the back were lagged inside with carpet cushion.

The port was cut equal to the area of the speaker cone to afford plenty of tuning range. Alongside it, a flap was mounted with a screw so it could be swung behind the port, partly closing it.

Next I laid the speaker, face up, on a table, hooked it to the amplifier with a resistor in one lead as the instructions said, and played Band 1, Side B of the test record. This is a 300-to-20-cycle glide tone, which constantly changes pitch downscale until it bottoms at 20 cycles and starts over again.

Just before the cricket snap that marks the 50-cycle point, the sound came up loud. I could see cone vibration increase, and feel the sharp boost in output with my fingers. It indicated a free-air resonance of about 60 cycles.

Mounting the speaker in the box, I

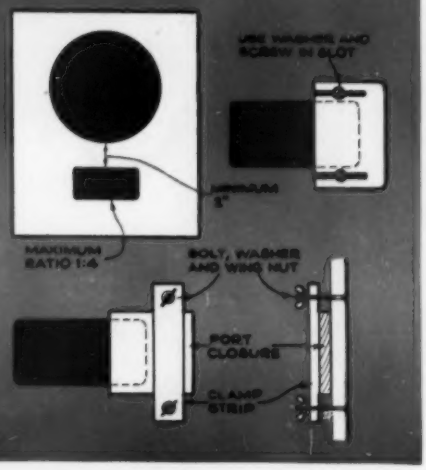


THE PORT IS TUNED by sliding or turning a plywood flap to cover more or less of the opening. Since the back of the cabinet must be in place for tuning, this is done from the outside as shown. An AC voltmeter, although not essential, makes peaks visible as well as audible. It is connected across the voice-coil leads beyond the resistor, as in the drawing above.

"I checked for buzzing joints"
"Panel resonance was easy to spot"
"Tuning the port made all the difference"
POPULAR SCIENCE
Hi-Fi Test Record
Side A

CABINET VOLUME (cubic feet)	PORT AREA (square inches)		
	8" Speaker	12" Speaker	15" Speaker
2	35	—	—
3	80	—	—
4	130	50	—
6	—	100	35
8	—	175	60
10	—	250	80

PORT AREAS here are oversize to compensate for differences in speakers. Make the flap big enough to cover two-thirds of the port. To find cabinet volume, multiply width by depth by height, all in feet. At right, two kinds of sliding closures.



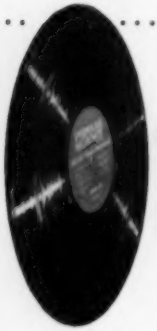
hooked it up without the resistor, left the port flap wide open, and listened to an FM station. It was as bad as I'd expected. The announcer's voice seemed to come out of a rain barrel. Different bass notes in music boomed with monotonous sameness. I replaced the resistor, played the glide band on the test record.

Instead of one resonance peak, now I got three! On each sweep of the glide tone, I heard them plainly. Then I happened to look at the tone arm, and noticed it vibrating at one point.

Some tone arms, I recalled, may resonate in the audio range. Turning the volume control down, I flipped the record over to the sixth band on Side A, a 20,000-to-20-cycle glide tone recorded at maximum level. Airborne "needle talk" could be heard plainly. When the tone swept below 100 cycles, it suddenly became louder, and the arm shivered as if about to bounce right out of the record groove.

The fix was easy. A little at a time, I packed modeling clay into the pickup head, around and behind the cartridge, not forgetting to readjust the counterbalance spring to keep stylus pressure light. Adding mass this way lowered the arm's resonance point until it began to shiver only just before the band hit bottom at 20 cycles.

With the volume up again, I played the 300-20 glide band and this time got two peaks. Timing them from cricket snaps, I estimated the louder at about 100 cycles, and almost as high as the



How to Order Your Popular Science Hi-Fi Test Record

THIS *unique disc is available at present only directly from* POPULAR SCIENCE, *at $2.50 for one record or $4 for two. Full instructions for its use are included.*

You may want two. The extra record makes an unusual and highly welcome gift for any hi-fi fan, present or future. Or you may want to keep it, unplayed, as a reference standard to check the one you use regularly.

Send cash, check or money order to Dept. 357, POPULAR SCIENCE MONTHLY, *353 Fourth Ave., New York 10, N.Y.*

free-air peak, and the lesser at 40 cycles. A borrowed AC voltmeter confirmed this.

Turning the flap to cover a bit of the reflex port didn't help at all, so I finally swung it to cover half the port. Surprise! The 100-cycle peak was much lower. It became a game to see how nearly equal I could bring the two peaks.

Tuning the port made all the difference. Eventually I got the peaks equalized, and both far lower in amplitude than the speaker's free-air peak.

Loose panels or joints, the instructions said, could be found by taking out the resistor and playing a glide band at high volume. I was sure my box was solid, but I checked anyway—and got buzzes.

My fingers told me these were from the back joints. Panel resonance was easy to spot, too. At one point on the band the whole back panel shook.

I screwed a one-by-two edgewise diagonally across it, drove an extra screw between every two in the joints, and heard no more buzzes.

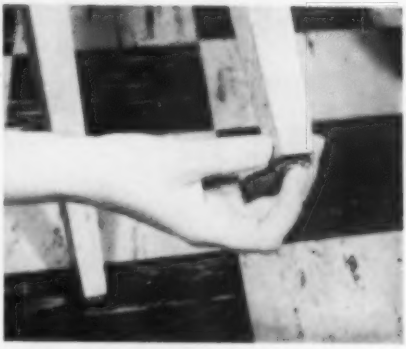
That FM announcer, when I switched him back on, had climbed out of the rain barrel. A cello recording came through with solid, true-to-pitch bass instead of a synthetic boom. Satisfied, I installed the grille cloth, shoved the speaker box into the cabinet, and played some records. But some of the sparkling highs were missing now.

The voice-announced frequencies on Side B's second band told the tale. The 10,000-cycle tone wasn't coming through.

I ripped off the heavy grille cloth; back came my 10,000 cycles. I installed lighter grille cloth. Now highs stayed in, the record's music-box selections sparkled, and bass passages in other music came alive. The test record had turned my boom-box into an orchestra seat.

It worked so well that I'm lining up other jobs for it, like setting my equalization controls exactly on the RIAA curve used by recording engineers, and checking my stylus before it wears enough to damage grooves. Here's a record that won't gather dust. By using it occasionally I'll be sure to get the most out of the equipment I have. END

How to Protect Asphalt-Tile Floors

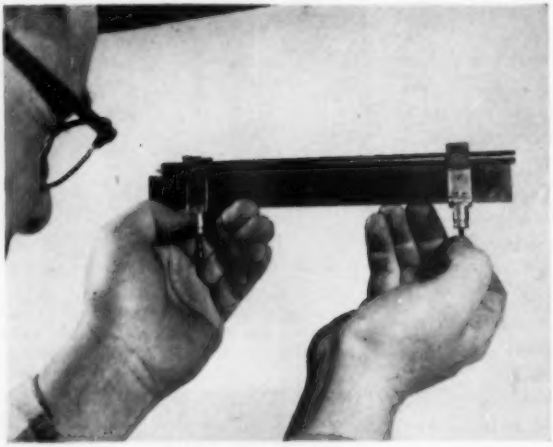


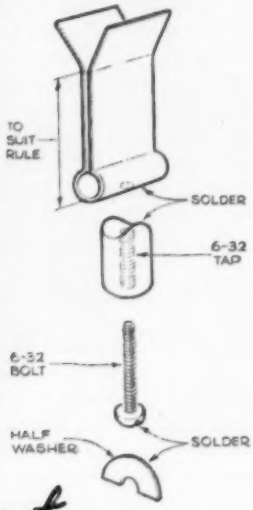
PICK FURNITURE GLIDES WITH CARE or they may dig into the tile surface. Use glides that have a smooth flat base, rounded edges and a flexible pin to maintain flat floor contact.

USE SOFT-RUBBER LEG CUPS under heavy furniture that is not frequently moved. Otherwise, the legs will dig into the tiles. Don't use hard cups or domed metal glides.

TO REMOVE MARKS that don't yield to ordinary scrubbing, rub the surface lightly with No. 00 steel wool, using a concentrated solution of neutral soap or cleaner in warm water.

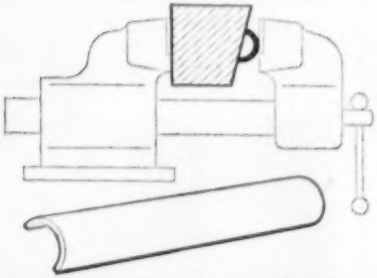
PS Shop Notebook





Cradle Checks Shaft Alignment

An out-of-true shaft or rod is easy to detect with this homemade tool. To use it, lay the shaft in the cradle and thread the bolts up from below until they contact and raise the rule to a position that leaves a hairline gap between its upper edge and the shaft. If the shaft is true it can be rotated without varying the width of the light gap. To measure a bend, use a suitable feeler gauge.—*Joseph Tracy, New York City.*

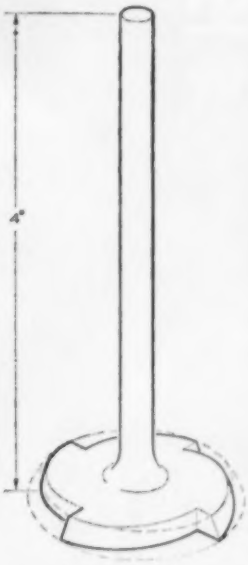


Holding Tapered Stock

To grip stock with non-parallel faces in a vise, place a split piece of pipe between one jaw and the work.—*Hugh Lineback, Stillwater, Okla.*

Flexible Rule

Cut a strip of sheet lead the size of a thin machinist's rule. Clean one face, coat with soldering paste, and tin with a thin layer of acid-core solder. Sweat-solder the rule on. It will keep the contour of curved surfaces while you measure. Use it, too, to transfer curves from drawings to stock.—*H. J. Gerber, Stillwater, Okla.*

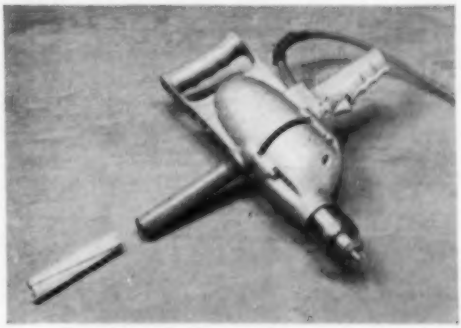


Valve Converts to Polishing Head

A polishing head that can be chucked in your drill press for burnishing metal is easily made from an old car-engine valve. Heat the valve cherry red and let it cool slowly to remove the temper. Saw off about 1½" of the stem, and file the head as shown. The projections will grip a steel-wool pad firmly. By boring a hole through the stem for string, you can also tie a chamois to the head.—*J. M. Finn, Pittstown, N. J.*

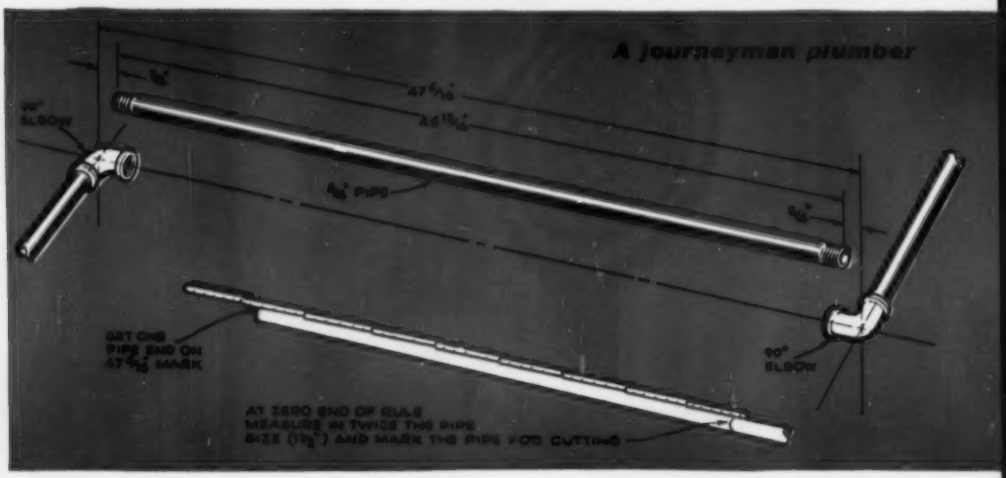
HAVE YOU TRIED THIS?

To store parts lists and manufacturers' instructions, the detachable handle that comes with many electric drills is a good place. Also, attach the chuck key to the electric cord with a few turns of friction tape.—*Theodore Wirbisky, Shenandoah, Pa.*



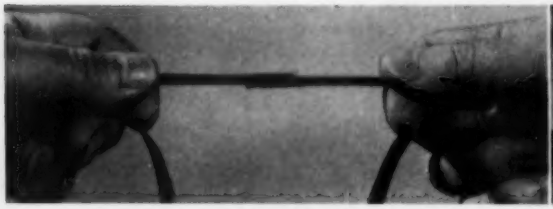
Now Any Man Can Sew

Replacing a zipper is a cinch. Just apply some liquid mender sparingly from the container.

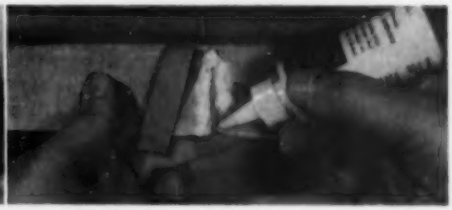


NEW liquid menders now on the market make every man a potential tailor. A fabric-to-fabric bond made in 60 seconds will withstand washing, ironing and even boiling—only dry cleaning is not recommended. You can use the liquid mender on anything from sheer fabric to heavy car upholstery and canvas.

Liquid menders include "No Sew," made by Unique Products, 330 S. Wells St., Chicago 6; and "Magic Thread," Utility Products, Valatie, N. Y.



SHOELACE BROKEN? Apply liquid to ¾" of each end; press the ends together for 60 seconds.



AWNING RIPPED? A tear in the covering of a lawn chair? Apply a simple patch like this.

THREADBARE EDGES on clothing go down, and stay put, when you spread on the liquid.

FOR AN INVISIBLE REPAIR, fit in a matching patch, support it with a backing patch (right).

tells you How to Cut Pipe to Fit

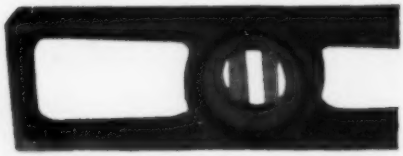
WHEN cutting pipe, you must deduct a certain amount at each fitting. If you are using 90° elbows and a pipe size between ½" and 1½" (pipe sizes always refer to the inside diameter), the measuring job is easy.

Pipe should always be laid out using centerline-to-centerline dimensions. Just deduct twice the pipe diameter from any desired centerline-to-centerline dimension and you have the correct length for the pipe section.

For example: You want to make a 90° offset in an already established ¾"-diameter pipe, to move the line over 47 5/16". Cut a pipe section 45 13/16" long (47 5/16" minus 1½"—twice ¾"). When you thread the pipe ends and couple them to two 90° elbows, you will have exactly the 47 5/16" spacing you want. In actual practice, you don't have to do your figuring on a scratch pad. If you know that the centerline-to-centerline measurement is 47 5/16", place one end of the pipe to be cut at the 47 5/16" mark on your rule. Go back to the zero mark, measure in twice the pipe diameter, and mark the pipe there, for cutting.

These tips come from Loyd Weaver, a journeyman plumber in Phoenix, Ariz.

The Spirit Levels You Should Own



A LEVEL, in careful hands, is a precision tool; in careless hands, it can cause a mess of trouble. It can be accurate to 1/16″, or less, in 100′, or off as much as several inches—just by the way you "read" the bubble.

In every job from trimming a hedge to building a house, some lines must be set level (horizontal), others plumb (vertical). If they aren't true, nothing will fit right, look right or be as strong as it should be.

The basic leveling-plumbing device is the spirit level. This is a slightly curved, transparent vial (also called a glass) that's partially filled with a non-freezing liquid such as alcohol. When the vial is set curve side up, an air bubble rises to the top, centering itself at the midpoint of the glass.

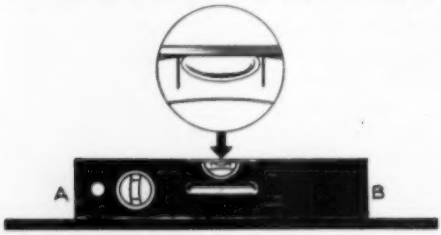
The vials do many different jobs depending on how they are mounted. You can buy a tiny level to string guide lines, attachments that will convert an ordinary carpenter's level into a sight level for surveying, and fancy protractor levels for measuring angles.

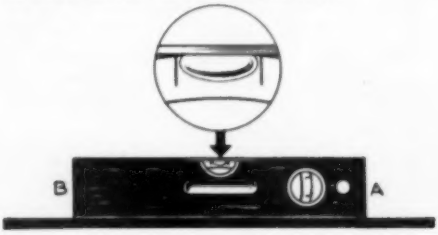
How many do you need? Levels come all the way from 3″ long, with one vial, to 96″ long with 10 vials. But there are three types—for a total cost of about $10—that will handle most home jobs and can also be used for outdoor surveying.

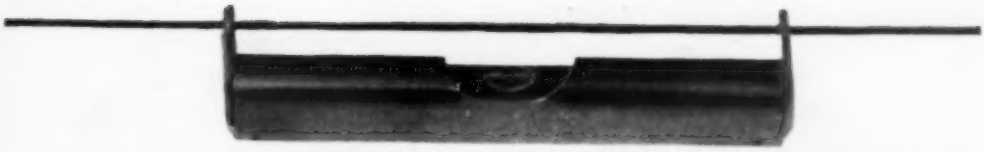
The basic carpenter's level is 24″ long and has six vials—four for plumbing and two for leveling. For tight places where the 24-incher won't fit, a smaller "torpedo" level, about 9″ long, works well but is less accurate. It gets its name from its special round-ended shape, which slips easily into your pocket without snagging. Most torpedo levels have three

How to use a level to test itself

PLACE A NEW LEVEL on any nearly flat surface and shim it up with paper or cardboard until bubble comes dead center. Then reverse the level end for end and put it down in exactly the same position. If bubble is off-center, level is inaccurate. To test plumb vials, use same method, holding the level against a vertical surface. Check all vials separately.







3″ line level—used in laying out gardens, terraces and walls.

24″ bar level—to make accurate carpentry jobs around the home.

9″ torpedo level—a handy pocket model to fit into tight spots.

vials (level, plumb and 45-degree vial).

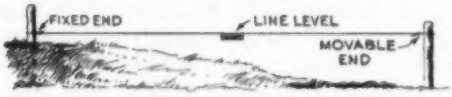
The third type is a tiny 3″ line-and-surface level with one vial. Because of its short length, this is least accurate on surfaces, but can be very accurate when used to string lines.

Some levels come with fixed vials, and these should be checked in the store before you buy one. A simple method of testing a level is shown in the sketch on the facing page. Levels with adjustable vials are a bit more expensive but will permit resetting later or replacement if a vial becomes damaged.

Why so many vials? Having six (or more) vials in a single level may seem like a dubious luxury, but you'll find them a big help. The vials are arranged in pairs, back to back, so that no matter how you pick up the level you always have at least one or two vials in operating position.

In the 24″ six-vial level, the two leveling vials are set parallel to the frame for

How a line level helps you build outdoor projects

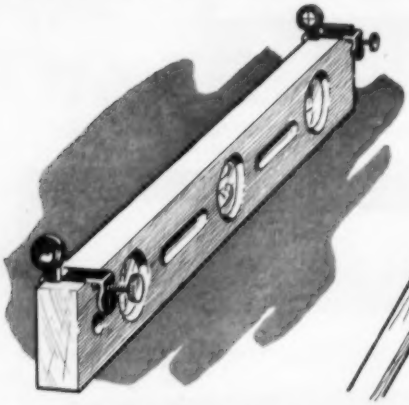


PLACE LEVEL at exact midpoint of line to equalize sag, and raise or lower one end until bubble centers. Use nonstretch mason's twine.

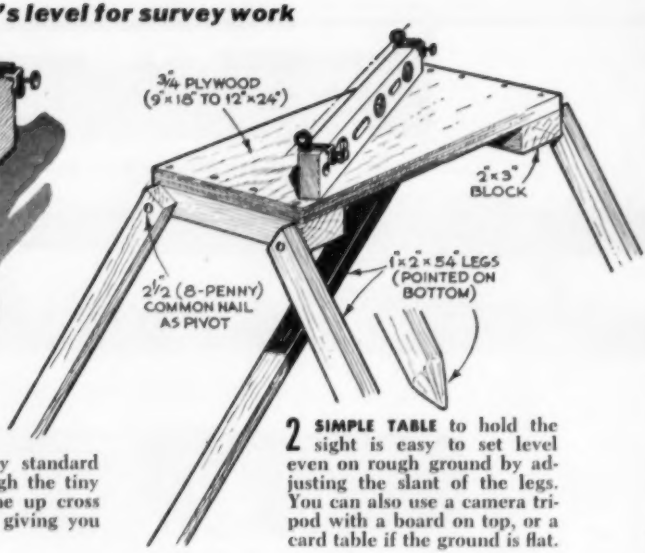
FOR GRADING, measure from line to ground to guide you in digging or filling a level area. Retighten and relevel line every few hours.

TO LEVEL WALLS, set line at top of each course of bricks or blocks, then remove level to avoid sag. Raise line after each course.

How to set up a carpenter's level for survey work



1 INEXPENSIVE SIGHTS clip on any standard carpenter's level. Looking through the tiny peephole in the front sight, you line up cross hairs in the rear sight on a target, giving you a straight, level "line of sight."



2 SIMPLE TABLE to hold the sight is easy to set level even on rough ground by adjusting the slant of the legs. You can also use a camera tripod with a board on top, or a card table if the ground is flat.

use on horizontal surfaces. The four plumb vials are set crosswise to the frame. When the level is used against vertical surfaces, these vials are in a horizontal position.

By following two simple rules you can make sure that you read the right vial correctly:

- In double-vial levels (two vials paired together), always read the *lower* of the two vials. (The top one is upside down and will not operate properly.) In single-vial levels, the vial must be turned curved side up.
- In plumbing a vertical surface, remember that the surface tilts *away* from the direction in which the bubble moves (if the bubble moves to the right, the surface tilts to the left). In leveling horizontal surfaces, the bubble moves *toward* the high side of the slope.

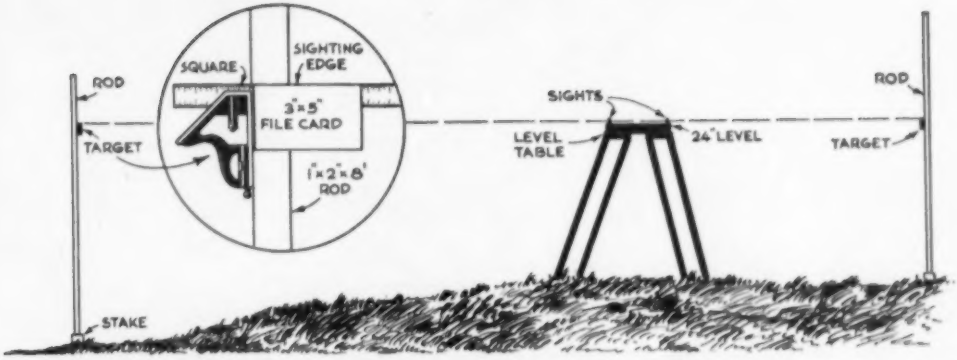
How accurate must you be? In finishing a door opening and in many other jobs in finish carpentry, the ½″ bubble of a 24″ level can't be off center more than 1/16″. If it's off ⅛″, the jamb or side of the opening will slant about the same amount in 24″. In the 78″ height of the door, that slant will amount to ⅜″. If the other jamb slants that much in the opposite direction, the door would have to be ¾″ wider at one end than the other!

On the other hand, an ⅛″ deviation in the head jamb (the top of the opening) wouldn't be first-class carpentry, but it would get by. Appliances are usually adequately leveled at ⅛″ off center on a ½″ bubble.

The sills, beams and joists in a house must be accurately laid, since any error here is transmitted upward. Wall studs can tilt a bit sideways, but must be absolutely straight edgewise to provide a flat wall surface.

In general, horizontal surfaces that are slightly off are less noticeable to the eye than vertical ones. Shelving can slant as much as 2″ in 6′ before it becomes really bothersome, but that wall had better be straight. Kitchen counters and other built-ins that involve joints should be true to 1/16″ or better, or you may have trouble fitting them.

Levels aren't just for leveling. Often in installing drains, pipes or walks it's necessary to build in a deliberate slope. If you remember that an ⅛″ deviation of the bubble in a 24″ level amounts to



3 TARGET TO SIGHT ON is made by taping a white file card (or paper) to a try square. This is then slid up and down a one-by-two rod until the top edge of the card lines up with the sight level on the table. Distance should be kept within 60′, but by taking two sights in opposite directions, you can span up to 120′ from one table position. For greatest accuracy, take several sights to be sure you're "on target," then reverse the level (reversing the sights, too) and take several more sights. The final target position is then set at the average mark between the two sets of sights. If you have trouble getting the table dead level, use slips of paper or cardboard to shim up one end of the sight level itself until the bubble centers.

about an ⅛″ slope in two feet, you can easily figure out the total slope in, say, 10 feet (⅝″), or the pitch (1/16″).

By slanting your level until the bubble is off-center the right amount, you'll have the slope you want. This works well on slopes that aren't critical, permitting the bubble to be approximated by eye.

For precise angles, such as the pitch of a roof, you can get a protractor level that has a rotating vial set in a degree-calibrated scale. You can read angles directly by turning the vial until the bubble centers. Other, fixed vials provide regular plumbing and leveling.

Ordinary levels with adjustable vials can also be set to any desired pitch or angle, though this may be troublesome unless you're doing a lot of work at the same setting.

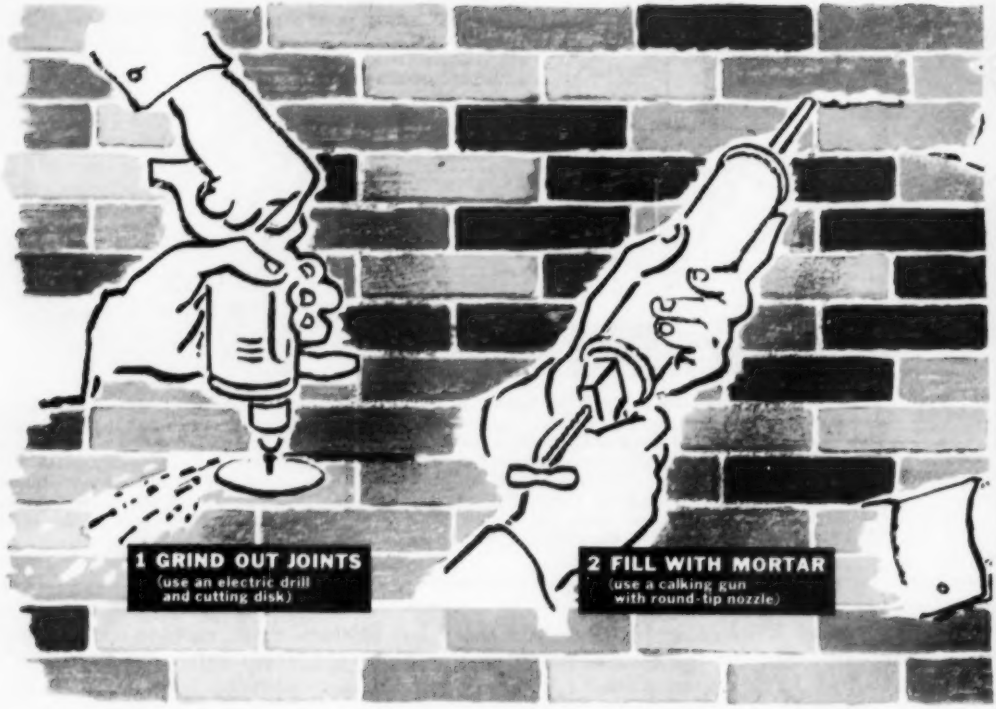
Leveling with a line. Here's where that tiny 3″ level, usually purchased for $1 or less, will help you lay out lines for walls, terraces, pools and other jobs.

The level has hooks on top and is hung from a cord stretched between two stakes, as shown in the sketch on page 205. The cord then gives you not only two points of equal height, but a guide line between them, such as for building up straight, even walls.

The line must be kept taut and the bubble exactly centered before the level is removed. With care, you can stay within ½″ of true level at 60′, which is good enough for walls and foundations of garages and small utility buildings.

Sight leveling. For a house foundation, an accuracy of ⅝″ in 80′ is minimum good practice. You can't beat a surveyor with a $500 or $750 instrument—which can level to 1/16″ at 100′—but you can do a good job with a homemade sight level. This is based on the 24-inch level, a pair of sights that clamp to the level, and a thrown-together table to hold the level at a convenient height for sighting.

With the level set on the table (see drawing above), you then take sights on a target while a helper slides it up and down on a rod. When the target lines up with the sight level, a stake is driven in the ground beside the rod and marked at the target's height. For landscaping, the difference between the height of the level and the target height indicates the difference in grade between the two points.—*Carl Dreher.*



Pointing Up Masonry the

A SIMPLE way to solve a problem that often puzzles owners of masonry houses—repointing the brick or stone—is shown here, thanks to two PS readers. Reader Claude C. Fogelman of Northampton, Penn., asked in "I'd Like to See Them Make," May, '56, for a repointer made like a calking gun. Right back came a letter from reader J. E. Goetschius, who runs a building-maintenance business in Memphis, Tenn., saying that he always does the job with a standard, bulk-load calking gun. It's fast and neat. Here's Goetschius' recipe:

Start by grinding out the joints about ½" to ¾" deep, using an abrasive cutting disk in an electric buffer.

Mix regular masonry cement (not Portland cement) with finely sifted sand for the mortar. This mix should be the consistency of heavy cream and moist enough to press out of the gun. Attach a round nozzle to the gun and apply the mortar just as you would calking compound.

For a flush joint, strike off the portion of the bead that protrudes beyond the masonry with a trowel. For a beaded (raised) joint, drag the concave face of an old curling-iron top across the bead. For an inverted (concave) seam, reverse the curling-iron top and depress the mortar to the desired depth.

If you want to rake the joints, saw off a 4" section of two-by-four and cut a 1"-wide slot across one of the narrow faces at the center. Drive a 16-penny common nail into the slot, as shown in the top drawing on the facing page, letting the head project as high above the block as you want the joint to be raked out.

After the mortar has set awhile, press this face of the block firmly against the brick or stonework and run it along the

Easy Way

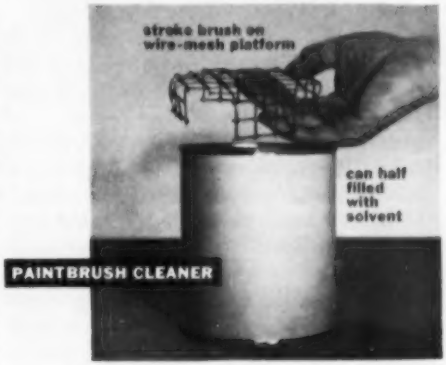
joints. The raked-off mortar will fall out through the slot.

To remove excess mortar that may have spilled onto masonry faces during a repointing job, wait until the joints have set thoroughly. Then give the wall an acid bath, consisting of one part muriatic acid and four parts water. (Muriatic acid is a commercial name for hydrochloric acid; you can get it at most large hardware and paint stores.)

Use enough of the wash to make it foam wherever it contacts the mortar. Apply it with a whitewash brush, then wire-brush and scrape with a putty knife. The undesired mortar will come off easily. Last, hose the wall with water.

While the one-to-four acid solution isn't strong, keep it off your hands as much as possible and keep a bucket of clean water handy, to rinse them in from time to time. END

4 Home-Shop Uses for Tin Cans



5 Proven Ways to Build

Good cabinetwork calls for trim and durable drawer joints.

By Bill Baker

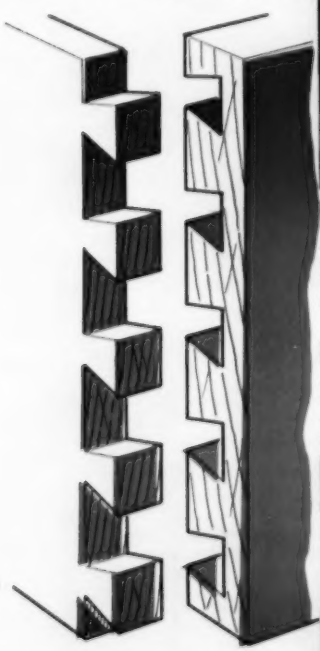
IF YOU have a drawer-building job to do, it will pay you to use one of the time-proven assembly methods that have been developed by professional cabinetmakers. Of the lot, the drawer joints that are in most general use today are the half-concealed French dovetail, the open French dovetail, the rabbet assembly, the lock mortise, and the dovetail mortise.

These five joints are all strong, rigid and durable, but the one best for you will depend on your particular needs. Here's how professional furniture makers rate the joints as to durability and best use.

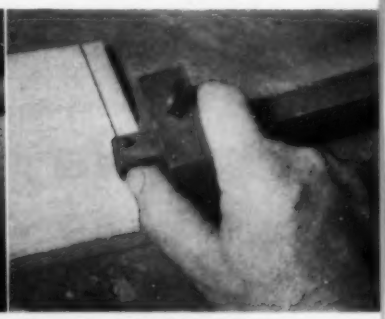
• French dovetail joints, both half-concealed and open, are the oldest and most popular for fine furniture making. When accurately cut, they provide maximum strength and rigidity. The half-concealed type is used where drawer sides are mounted into the drawer front, and the open type for the backs of drawers.

• Rabbet assemblies are the simplest and most common drawer joints. By using them, the do-it-yourselfer can get good results with comparatively little work. They require a few finishing nails in addition to gluing, or No. 6 flathead screws if the drawer is large. The nails or

How to make a half-concealed French dovetail



1 MAKE GUIDE LINES on the ends of the drawer front with a marking gauge, to indicate depth of concealed dovetails. This dovetail depth should be two-thirds the board thickness.



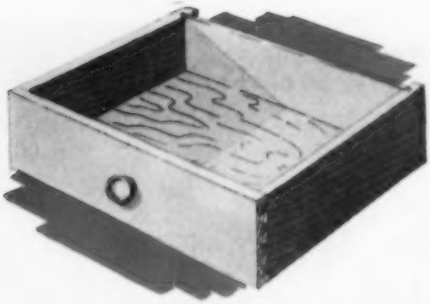
2 WITH THE SAME SETTING, use the marking gauge to indicate dovetail depth at the front of each drawer side. Then turn boards over and mark them similarly on the opposite sides.

6 REMOVE STOCK with a sharp, narrow chisel, lifting chips out through the inside face of the drawer front, rather than the edge. Clear undercuts after removing the center portions.

7 ALIGN THE INSIDE FACE of the drawer front with mating drawer-side guide marks after cutting and trimming dovetails. Trace the dovetail outlines accurately onto the drawer sides.

Drawers

Here are the most popular types.



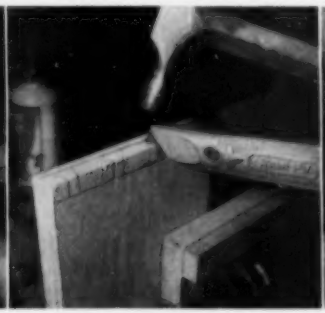
screws should be countersunk and the holes filled with wood putty.

• Lock mortises were first used by cabinetmakers to replace the French dovetail with a very rigid and all-machinemade joint. Since then, special dovetail routers have offset this advantage. But if you own a table saw you'll find lock mortises easy to cut and highly satisfactory for interlocking drawer fronts and sides.

• Dovetail mortises are especially suited to locking sides into a drawer front which is to lap the front edges of a piece of furniture. That's because the grooves for these concealed joints can be placed anywhere along the inner face of the drawer front. At the same time, thanks to the dovetail-like shape of these cuts, mating tongues on the front edges of the drawer sides get a grip that withstands drawer pull better than any other assembly method, with the possible exception of the French dovetail.

Pictures here and on the next four pages show how to make these joints.

3 USE MARKING GAUGE on inner face of drawer front, to indicate thickness of a drawer side at each end. Make guide marks for dovetails. Saw diagonally between the stop lines.

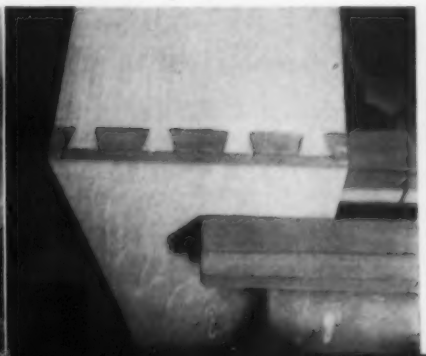


4 USE A SHARP KNIFE (a mat knife is best) to square off the diagonal saw cuts to full depth. Force the blade down by tapping its back with a hammer. Don't stray from saw cuts.

5 CUT ACROSS BASE LINES of the dovetails' open sections with your knife before starting to chisel the wood out. This will insure accurate and clean-cut edges for a professional fit.

8 SAW TO THE STOP MARKS along each dovetail line, holding your backsaw at right angles to both drawer-side faces. Keep cuts on open-section sides of all lines for a snug fit.

9 USE A KNIFE, again, to start base cuts that will clear the open sections. Do this on both faces; then complete the cuts with a chisel, working in to the center from both faces.



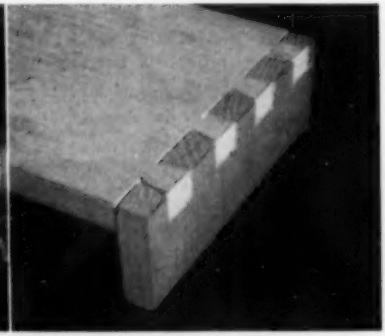
10 FINISHED JOINT is snug and will remain strong, even if the glue applied before assembly dries out at a later date. Never use nails when making a French dovetail joint.

How to make an open dovetail

1 USE OPEN DOVETAILS to attach the back to a French dovetailed drawer. Mark thickness of a drawer side at each end of the drawer back, on both faces, to serve as stop marks.

2 CUT DOVETAILS in the drawer back first, using contours shown. This way, you can drive the back in place last, locking the drawer bottom in its grooves and binding the assembly.

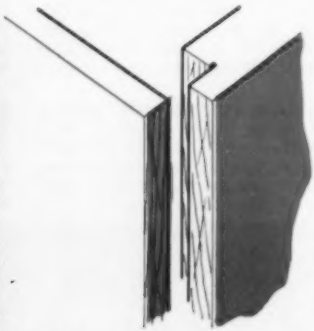
3 WITH DOVETAIL MARKS traced on back edges of the drawer sides, saw perpendicularly to stop marks. Remove open-section stock with knife and chisel, angling tools.



4 OPEN DOVETAIL JOINT is assembled. It takes patience and practice to produce precision fits like this, but French dovetails are the hallmark of the good furniture builder.

How to make a rabbet assembly

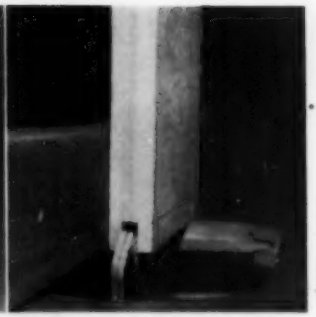
1 SET UP TABLE SAW to make kerfs halfway through drawer-front stock. Distance across saw blade to fence should equal the thickness of a drawer side. Cut kerfs at both ends.



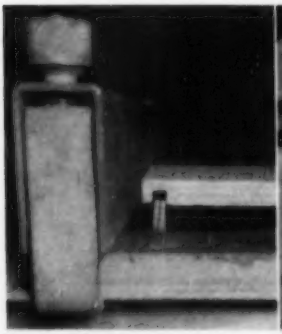
2 UP-END DRAWER FRONT and make a second set of cuts to clear the rabbets. Cutting a bit deeper than the drawer-side thickness insures a sharp corner and offers a glue groove.

How to make a lock mortise

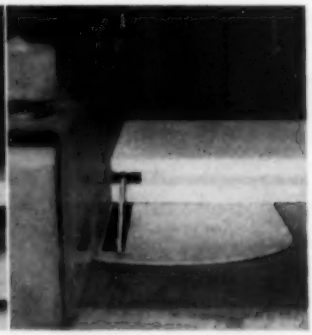
1 WITH A MARKING GAUGE, make saw guide marks on the side edges of the drawer front, one-third the thickness across them from the outer drawer-front face.



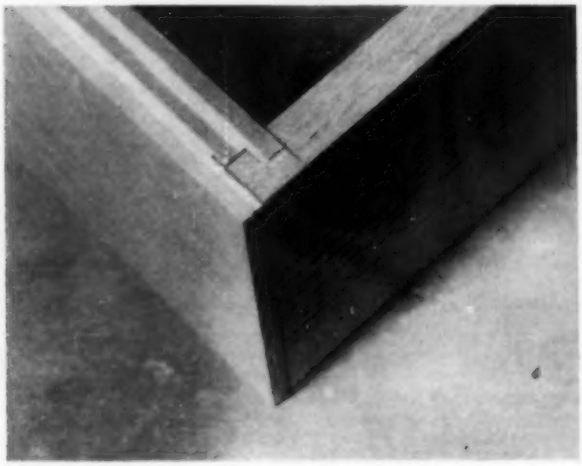
2 BEHIND GUIDE LINES at both ends of the drawer front, cut grooves one-third as wide as the thickness of the stock, and as deep as the thickness of the stock used on drawer sides.

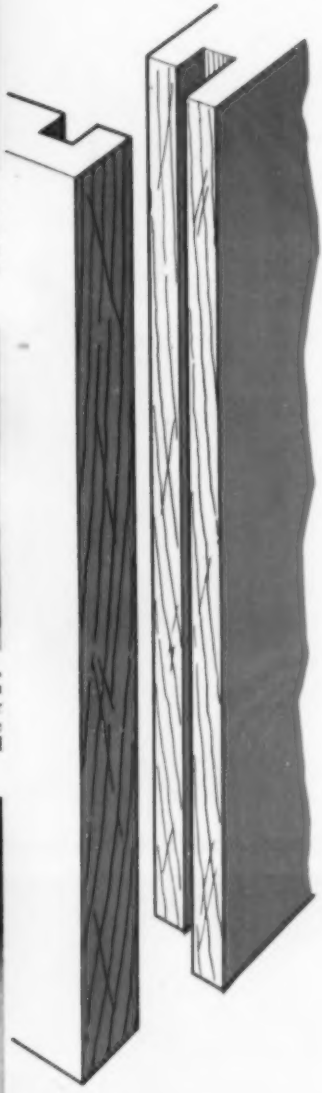


3 ON INSIDE FACES of drawer sides, measure in one-third the thickness of the drawer front and cut grooves as wide as those in drawer front, half through stock.



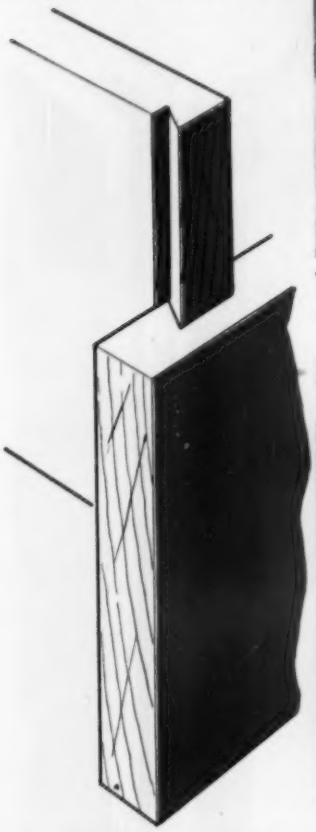
4 FINAL CUTS, made as shown, trim the mortise tongues on the inside face of the drawer front to the same length as the mating grooves on the forward edges of the drawer sides.



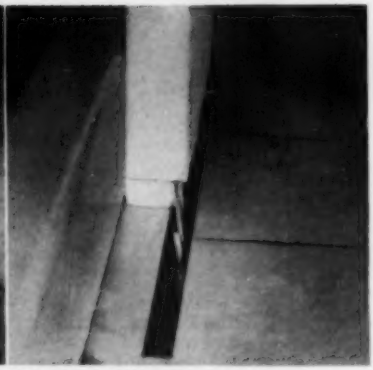


5 INCONSPICUOUS BUT SOLID, the lock-mortise joint provides plenty of area for gluing. Nailing isn't necessary, but if you do use finishing nails, drive them from the drawer front.

How to make a dovetail mortise



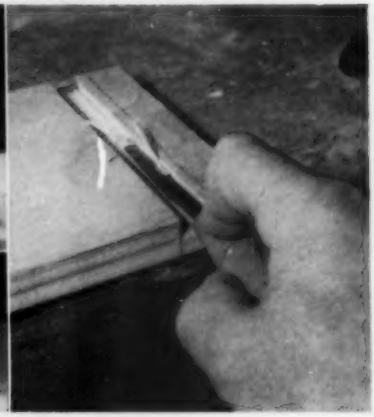
1 AT FORWARD ENDS of drawer sides, mark mortise groove depth on both faces of stock.



2 AT OUTER FACE MARKS, cut shallow grooves. Finish dovetails with angled edge cuts.

5 MORTISE OUT remainder of groove with a dado, or a number of edge-to-edge saw cuts.

6 USE A NARROW CHISEL to clean out the ridge between diagonal and right-angle cuts.

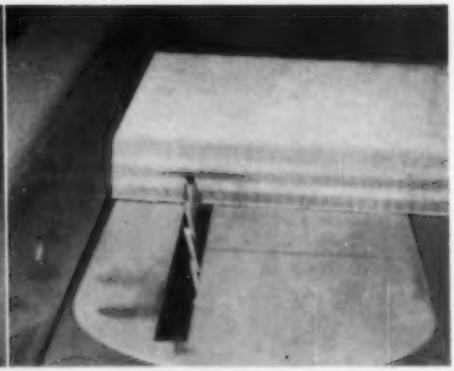


General techniques used in making drawers

1 STANDARD DRAWER BACK (French dovetail excepted) is mortised into the drawer sides. Grooves should be half as deep as side thickness, and from ½" to ¾" in from the edges.

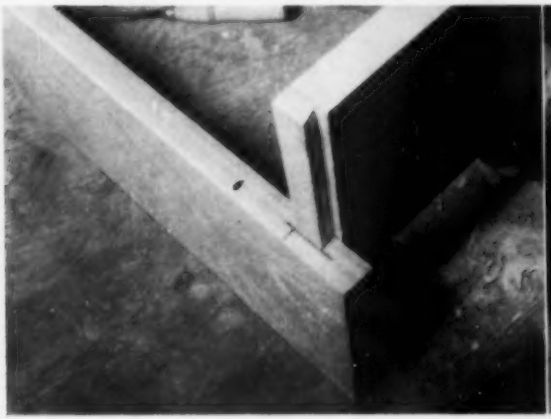
2 CHECK FIT of a drawer-back mortise, like this. Before drawer joints are permanently assembled, however, inner faces of the front and sides must be grooved for the drawer bottom.

3 SET DOVETAIL SECTIONS of sides at desired locations on the top edge of the drawer front and mark around them for groove guides.

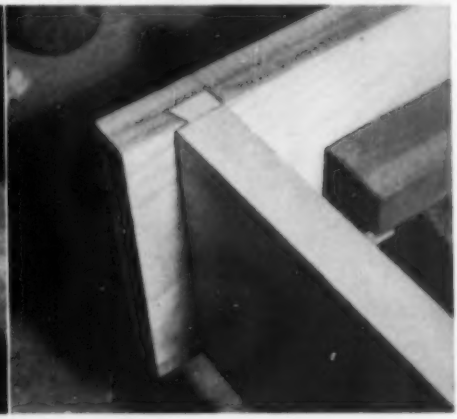


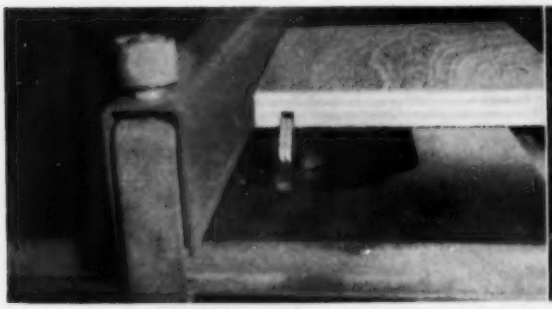
4 WITH SAW SLANTED to the correct angle, make cuts for the dovetail mortise grooves on the inner sides of the guide lines.

7 INSERT DRAWER SIDES as shown. Because the angled sides of their tongues are opposed, one drawer side reinforces the other.



8 COMPLETED DOVETAIL-MORTISE JOINT resists drawer pull better than any other, with the possible exception of the French dovetail.





3 QUARTER-INCH STOCK is strong enough for bottom of an average chest drawer. Place ¼" grooves to receive it from ⅜" to ½" from bottom edges—higher for heavy-duty drawers.

4 TRIM DRAWER BACK so its bottom edge is flush with the tops of the side grooves. After final assembly, slide the drawer bottom into place and nail it to the drawer back. END

SUNLIGHT sifts through roof skylight—then ceiling skylight—and into the kitchen. After calking upper skylight, author ran beads of compound between the frame rims and the shingles.

How I Daylighted a Dark Kitchen

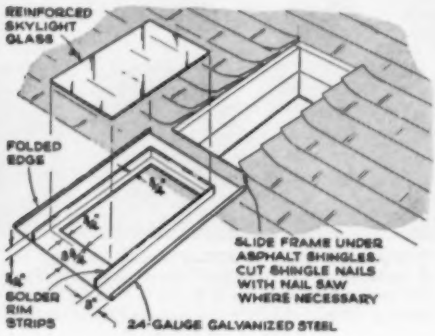
ALIGNED skylights in the roof and ceiling over our kitchen have changed an under-lighted north room into a cheery one.

After picking a spot for the ceiling skylight, I went into the attic. Finding no obstructions, I drove 8-penny nails up through the ceiling and shingles where I wanted the bottom corners of the roof skylight. The nails pierced the roof in the middle of a shingle course, so I drove two more down from above to mark the true corners at the bottom of that course. Another pair of nails marked the upper corners—also along a course line.

Before sawing out this opening, I had a local sheet-metal shop make a skylight frame like the one shown in the drawing.

After the roof opening was cut, I boxed it in with top and bottom blocks, and nailed one-by-threes on all four sides, flush with the sheathing. I slipped the metal frame under the side-bordering shingles at the bottom of the opening and worked it up the roof into position. Before nailing the frame to sheathing, I ran calking compound under the lower edge. I set a pane of skylight glass in the frame, using plenty of compound, top and bottom, for a watertight seal.

The kitchen-ceiling opening was framed like an ordinary crawl hole. Molding around it supports the glass. —*Charles L. Adams.*



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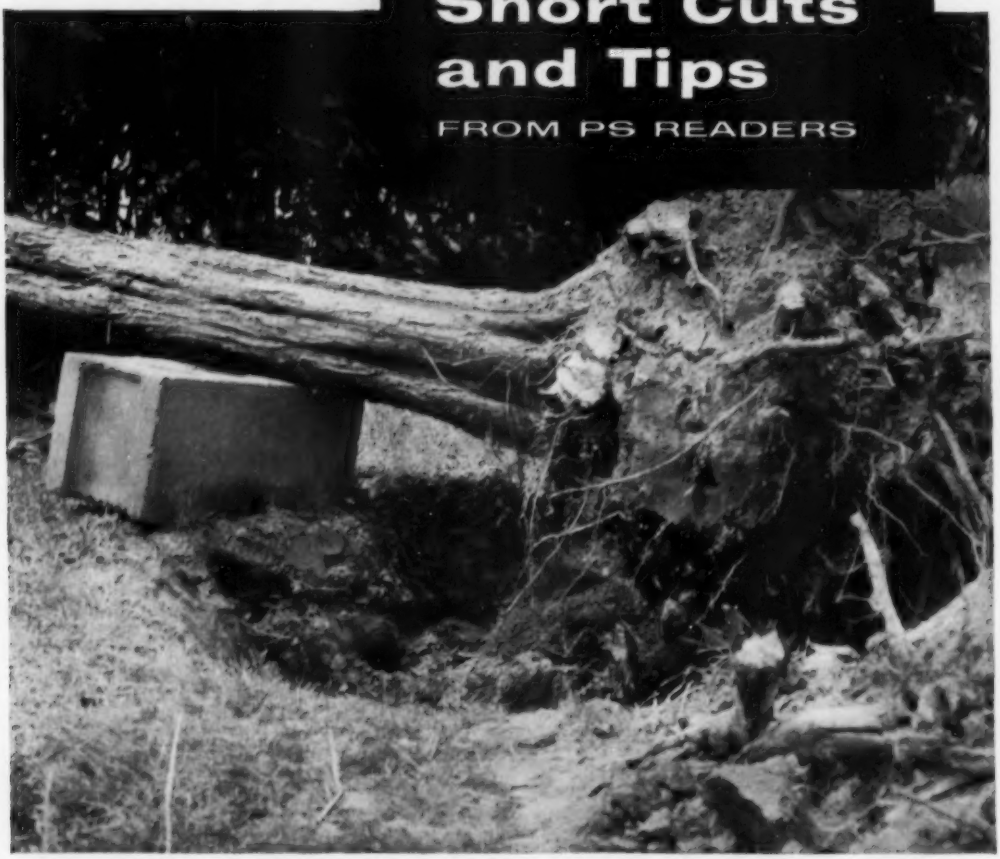
Short Cuts and Tips

FROM PS READERS

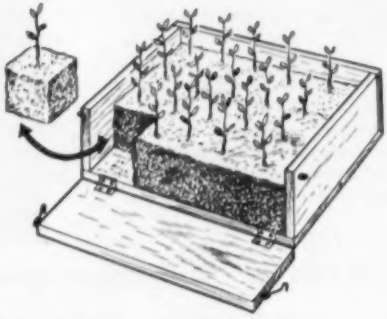


Cement Block Makes Fulcrum to Uproot Small Tree

THAT old and simplest of machines, the lever, will help you uproot small trees. Dig around the tree, cutting all surface roots. Fell the tree across a cement block placed just outside the excavation. The weight of the tree top will help pull the deeper roots free from the ground.

Rooting Box Has Drop Front

A HINGED front on my rooting box makes it easy to transplant seedlings without damaging their tiny roots. When the drop front is unhooked and lowered, each of the slips can be lifted out in a block of surrounding soil. I built the seed flat from 3/4" stock, but you can remove one side of any shallow wooden box and remount it on hinges.—*C. H. Hardy, Whittier, Calif.*



More Short Cuts on following pages

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Short Cuts and Tips

Taped Lunch Box Warns Drivers

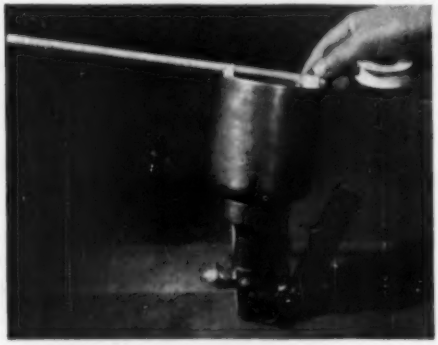
IF YOU work a night shift, reflective tape on your lunch box can make life safer. The moving signal will alert drivers when you walk poorly lighted roads or walk around dark cars on the plant's parking lot.—*Andrew Vena, Philadelphia.*

▶▶▶RECENTLY I had occasion to cut some irregular shapes from sheet polystyrene, using a scroll saw. I found out fast that the heat generated by sawing softens the plastic, causing the saw to bind. I fixed this by drawing a wet thumb and forefinger over a piece of soap and then rubbing them over the blade. Repeated several times during the sawing, this trick kept the blade from binding.—*H. Y. Ballou, Manhattan Beach, Calif.*

Stacked Cans Make Parts Bin

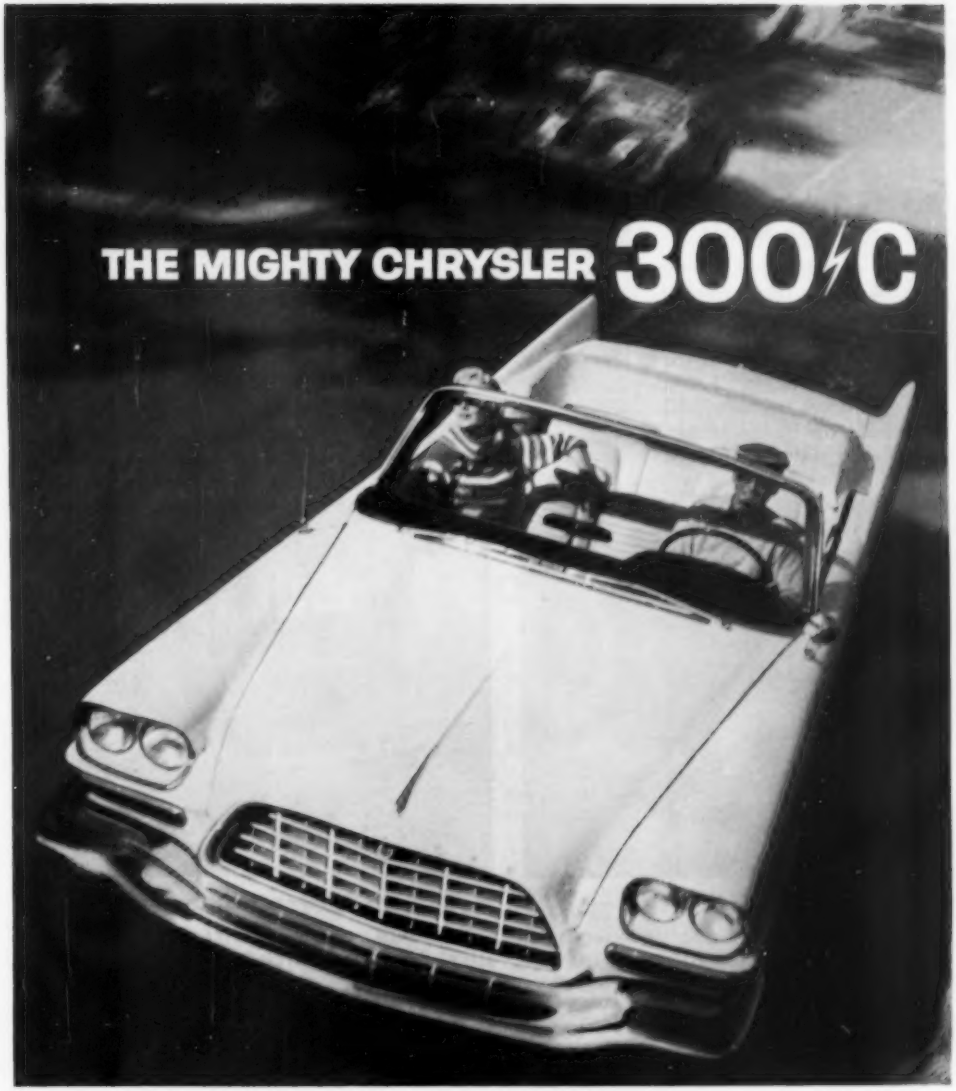
YOU can pyramid a few empty oil cans into a storage cabinet for small parts. Cut out two-thirds of each top and bend down the sharp cut edge or cover it with plastic tape. Stack the cans, spot-welding the rims at points where they touch. —*Charles L. Adams, Fayetteville, Ark.*

▶▶▶TO KEEP the ends of a rope from fraying when cut, try this: Wrap it first with friction tape for about three inches where the cut is to be made. Then cut through the middle of the taped portion. The tough wrap lasts longer than cord seizing. —*L. H. Wuesthoff, San Francisco.*



Dowel Guides Paint Sprayer

WHEN teaching students to handle a spray gun, a manual training teacher tapes a dowel to the paint container bottom. It serves to hold the gun at a uniform distance from the work.



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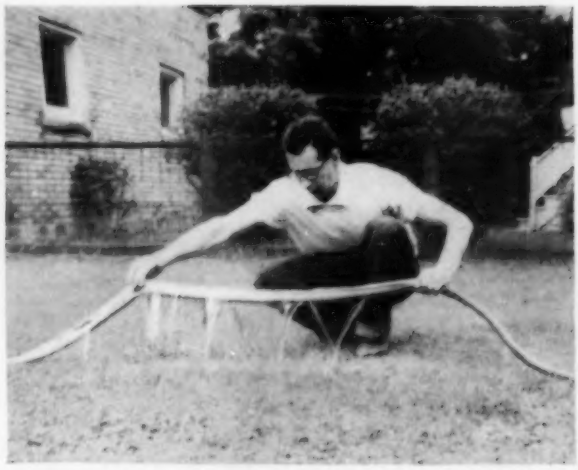
Short Cuts and Tips

Burlap-Tubing Hose Soaks Grass Roots

You can make a cheap soaking hose from burlap cut in strips and sewed to form a long tube. Make the end diameter a snug fit for the hose coupling. Lawn area and water pressure will determine the length to use. —*Arthur S. Green, Chicago.*



Putty Replaces Lost Cap

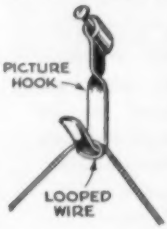
A WAD of putty or glazing compound is a good substitute for a lost cap to keep glue, oil, gasket cement and other shop supplies airtight. Knead it in your fingers to make a gob you can stick on a bottle applicator, can spout, or neck of a dispenser tube.—*Richard Day, Moxie, Ill.*

Bedstead Protects Cab Window

THE end section of a metal bedstead slipped into the stake holes of a pickup truck will protect the rear window of the cab. The frame also provides a place to tie a load extending above the box, to prevent it from sliding forward or backward.—*E. V. Reyner, Townsend, Mont.*

▶▶▶HERE is how one homeowner made water pressure dig under his concrete basement floor for a drainpipe. After breaking through at both drain ends with a cold chisel and sledge, he started a tunnel with a small shovel. Then he flushed it out with a tree-root watering spike. Pumping the spike back and forth a few times kept the water spurting and helped loosen the earth. It was worked from one end and sludge was bailed out at the other.

Two Picture-Hanging Tips



You can keep a picture hanging straight, if you loop the wire once around the hook. Thumbtacks, with heads protruding about 1/8" from the back of the frame at each lower corner, will keep the picture from marking the wall behind it.

With This Book

Here is a 96-page bargain! 18 projects you can build—all with plenty of pictures and illustrations, full material lists and complete step-by-step directions. Build cabinets, toys, games, built-ins! You can even remodel your kitchen. And this book—a regular 50¢ value when it goes on general sale—is yours with the coupon below for only 25¢! Send today!

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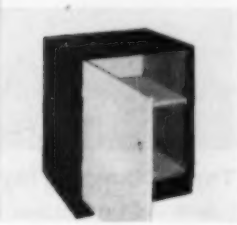
Early American hutch cabinet with built-in decorative planter.

2'-high play schoolbench with large storage shelf.

Convertible table that adjusts to coffee- or card-table height.



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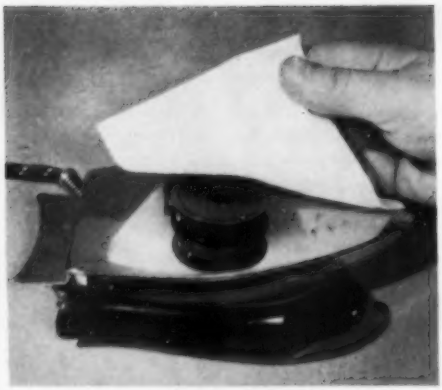
Short Cuts and Tips

Rings Hold Bow and Arrows

WOODEN curtain rings on a playroom wall or closet door will display archery equipment and store it out of the way. Use two rings for the bow, spacing them so that the lower end will slip into its ring when you push the upper end up through the top ring. Line the rings with tape or stick-on felt to avoid marring the bow's finish.

Blocks under the arrow rings act as stops. Put them close enough to the ring to keep pressure off the feathers. The quiver strap can be looped through an additional ring and knotted loosely.—*Frankie Waits, Dallas, Tex.*

▶▶▶An ordinary nutcracker can earn its keep opening stuck small screw caps when it's not busy cracking shells. Keep it handy in a kitchen drawer and anybody in the house can open a bottle of vinegar or a can of floor wax without calling for help.—*L. N. Steen, Solon Springs, Wis.*



Heat Freshens Typing Ribbon

WHEN a typewriter ribbon fades out and a new one isn't handy, try heating it to redistribute the ink. A good way is to lay the spool on the bottom of an electric iron set for lowest heat and cover it with a paper napkin. Warm for five or 10 minutes (but no longer) and it should be good for a lot more wordage. —*Karl MacMurray, Detroit, Mich.*

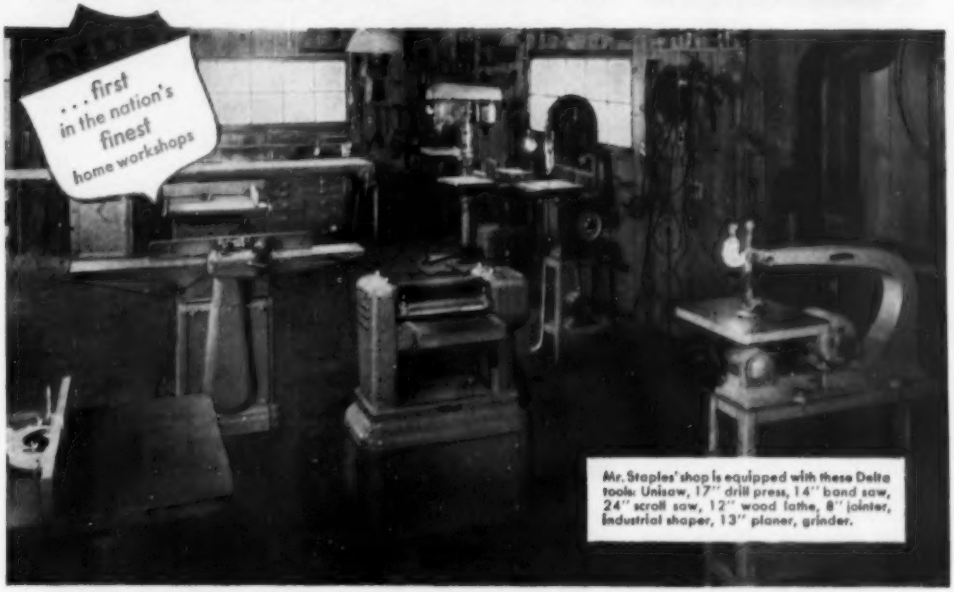
Tape Clamps Tiny Glue Job

SLIVERS broken out of a good piece of wood can be glued back invisibly if they are held securely while the glue sets. Masking tape does the job well, and you can remove the tape easily afterwards.—*Warner G. Tilsher, S. San Gabriel, Calif.*

▶▶▶WHEN you're patching plaster, wet down the cracks with water from an insect spray gun. The spray penetrates deep into the crack, but there's little excess water to run down the walls to the floor. This method is especially convenient if you're patching cracks or holes in a ceiling.

ROCKWELL-BUILT

DELTA POWER TOOLS



Mr. Staples' shop is equipped with these Delta tools: Unisaw, 17" drill press, 14" band saw, 24" scroll saw, 12" wood lathe, 8" jointer, industrial shaper, 13" planer, grinder.

"... finest built for home workshops,"

says H. A. Staples, Chico, California

Shown above is Mr. Staples' well-planned home workshop. Notice especially the excellent placement of tools to facilitate work-flow, and the ample drawer and cabinet space. Mr. Staples has good reason to be proud of his shop—and of his Delta Power Tools. Here's why:

EASY OPERATION —"Delta tools are so simple to operate," says Mr. Staples. "Even a beginner can turn out precision work with no trouble at all."

RUGGED, DEPENDABLE —"I also like Delta tools because I can rely on them to give me trouble-free operation without constant expensive maintenance and repair."

ACCESSORIES IMPORTANT, TOO —"Delta Accessories enable one tool to do the work of several, permit me to do a wide range of jobs with minimum investment," says Mr. Staples.

SEE THE ENTIRE DELTA LINE —Compare and see why Delta is *first* in the nation's *finest* home workshops. Your Delta Dealer is listed under "TOOLS" in the Yellow Pages. Or see Delta Homecraft tools at leading department and hardware stores.

Send coupon for complete catalog!

another product by ROCKWELL

Delta Power Tool Division, Rockwell Manufacturing Co.
504C N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send catalog on entire Delta Industrial line.
☐ Please send catalog on entire Delta Homecraft line.
☐ Please send names of my nearest Delta Dealers.

Name _____

Address _____

City _____ County _____ State _____

Short Cuts and Tips

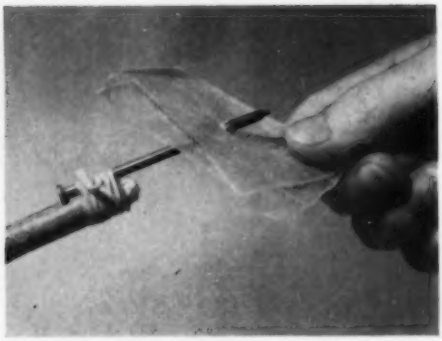
Flower-Box Base Anchors Lamp Post

By BUTT-JOINING four one-by-three's you can make a hollow post that is easy to wire and cap with a lantern. The top opening takes the fixture, which is connected to outdoor-type shielded cable run underground from the house and through the hollow center.

A brick planter shaped like a chimney will support it handsomely. Starting with several courses below ground, lay up the brick halfway, set in the preservative-treated post and anchor it in concrete. When this base has set, lay the rest of the brick and fill this section with topsoil. Be sure to leave a few openings in the mortar for good drainage.—*Hi Sibley, Nuevo, Calif.*

Pushed-In Can Holds Hot Iron

THERE may be thousands of ways to provide a stand to hold a hot soldering iron, but I think my way is about the simplest. I just crush in the top or side of any empty tin can that's around.—*Frank A. Javor, North Bergen, N. J.*



Nail Picks Up Paper Scraps

YOU can clean up scraps of paper fast after a picnic if you carry a long nail and a rubber band in the car's glove compartment. Bind the nail to a stick or a tree branch and you have a no-stoop retriever.—*Ken Murray, Colon, Mich.*

HEAVY FOOT WASTES GASOLINE

CAR DRIVERS who *watch their footwork* can get up to 50% more mileage from a gallon of gasoline. Here are some ways they do it.

Smart drivers *take it easy*. A *"swoosh"* start or beating the other guy at the light takes up to 60% more gasoline. Nervous "pumping" of the accelerator pumps unneeded gas to the engine, gives an over-rich mixture, *lowers* performance, wastes gas.

So much for the accelerator. What about the brake? You make a gas investment to give the car momentum. Useless braking *kills momentum, wastes gas*. Rushing up to a red light, turn or traffic jam, and then screeching the brake wastes plenty. Look ahead, *plan a smooth even pace* and you'll save gas—maybe even lives.

So watch your footwork and save!

STAYS "LIGHT" WHEN COLD
—LESS STARTING DRAG

KEEPS "BODY" WHEN WARM
—SAVES ENGINE WEAR

Here's another gasoline saver:

Most motor oils get "stiff" when cool—drag on the engine when starting and warming up. Not so with *Havoline Special 10W-30*. Fully fluid when cold it saves gas by lessening starting and warm-up drag, yet stays full-bodied and full-lubricating when warm. Also it guards against engine deposits for clean, power-packed performance. Switch to *Havoline Special 10W-30*, use *less* gas, get more power. Get this ultra heavy duty motor oil from your Texaco Dealer, *the best friend your car has ever had.*

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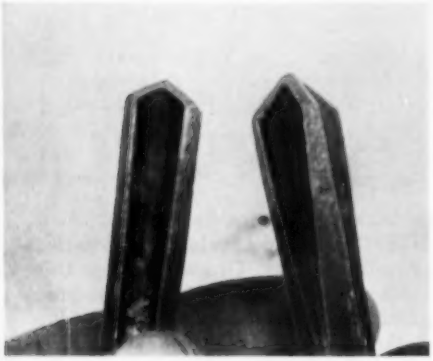
See newspaper for time and station.

THE TEXAS COMPANY

Short Cuts and Tips

Ride the Bow and One Oar Moves Boat

EVER lose an oar overboard? I've found that the easiest way to move a boat with a single oar is to straddle the bow and paddle the craft along from there. You can handle surprisingly large boats this way.—*C. R. Hull, Santa Ana, Calif.*



Two Star Drills Speed Work

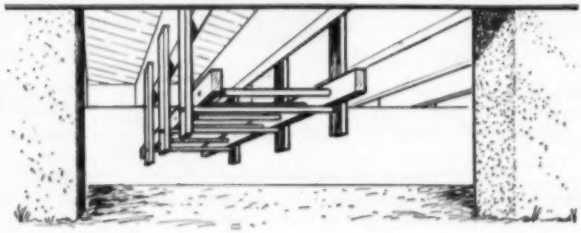
POUNDING holes in concrete with a star drill is faster if you use two alternately. Grind one to a standard angle (as at left) and the other to a sharper point (right). Alternate them every five or six strokes. The pointed tool cuts in the center, the other tool cuts at the edge of the hole.—*C. C. Cooley, New Buffalo, Mich.*

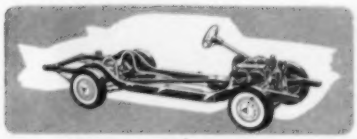
Emery Cloth Sharpens Tools

IF THERE'S no honing stone handy to sharpen a plane blade, chisel or other cutting tool, emery cloth laid on a flat, smooth surface will serve. Vary the pressure on the tool, bearing down hard first to wear the edge down even, then gradually lessening it to produce a keen working edge.—*Michael Ligocki, Gary, Ind.*

Crawl-Space Rack Stores Long Ladder

I STORE my ladder in the crawl space under my house. It rolls onto a trio of hangers mounted on the floor joists. Two one-by-two's drilled for a free-rolling dowel crosspiece make each hanger. Space dowels to fit the ladder.—*R. E. Bohm, Danville, Ill.*





X-RAY ON CHEVROLET

The biggest step forward since overhead valves—FUEL INJECTION!

With Ramjet fuel injection* the auto industry enters upon a whole new era of engine performance. For this is as important an advance as overhead valves—setting new standards of gasoline economy, of *instantaneous* acceleration, of smooth low-speed running and free-breathing maximum performance.

Fuel injection used to be limited to racing engines. But now Chevrolet offers a constant-flow port injection system that develops up to *one horsepower per cubic inch of displacement!* That's a summit of efficiency never before attained by any American production engine—and what it does for the 1957 Chevrolet you'll have to feel to believe. Try it—soon—and see! *Chevrolet Division of General Motors, Detroit 2, Michigan.*

**Optional at extra cost*

Now you see it; now you don't. Door pivots open for tuning, wider open to frame picture.

We Put Our TV Set in a Wall Hideaway

By Darrell Huff

ALTHOUGH our TV setup is a built-in, it's flexible enough to keep peace in the family. It can entertain all of us in the living room, give private shows for the children—or be banished from sight.

A vertically pivoted door that matches the wall conceals the set (perched in a closet) when it's not in use. For viewing, light pressure at one end of the door swings it out, leaving plenty of room to reach the side-mounted tuning dials. Open the door farther, and the heel section behind the pivots closes off the tuning area, framing the screen neatly.

We usually keep the set in this wall pocket, facing a couch on the opposite side of a small living-room alcove. There it doesn't disturb the whole family when the youngsters are riding the trail with Gene Autry.

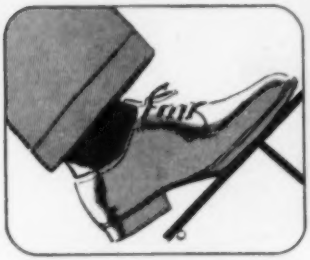
But there are times when we want to use the set for the whole room. With a simple, two-way antenna lead, we can. In the closet, we uncouple the lead from the set and switch it to a 40-foot extension that will reach anywhere in the room.

For all this, total cost of new materials was under $5.

There's nothing tricky about the instal-

"Stop paying the traffic toll . . . save gas the way professionals do!"

Mauri Rose . . . top professional driver, three-time Indianapolis 500-mile winner.



"Always drive with a steady foot. Uneven pedal pressure . . . slowing, then speeding up . . . burns far more fuel than cruising at a steady pace. And, take it from me, the steady pace is more relaxing and safer."

"In traffic, watch what's happening about 6 car-lengths ahead. This helps you maintain steady, thrifty speeds . . . avoid sudden stops and gas-consuming starts! And it lets you steer clear of dangerous situations."

"Remember, it's up to you to keep your car at peak efficiency. When most of your driving is in city traffic, it's a good idea to have your carburetor and other vital engine parts checked every 8,000 miles or so."

The way you drive may be costing you money! You can gain up to 5 miles per gallon of gas with thrifty driving habits and proper maintenance. And proper maintenance means regular carburetor and engine checks by a qualified, factory-trained mechanic. That's why more folks every day rely on Rochester Carburetor specialists . . . they know their cars are in the capable hands of *experts*. Rochester Carburetors are precision-engineered to give you top economy and high-compression power . . . precision-serviced to stay that way!

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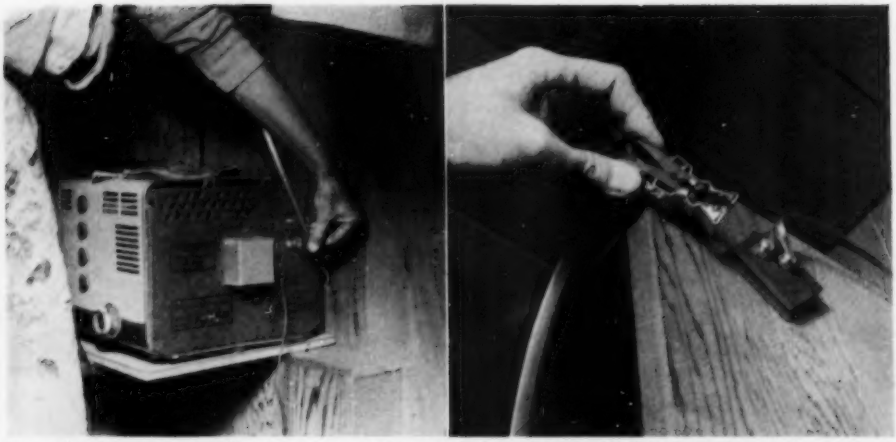
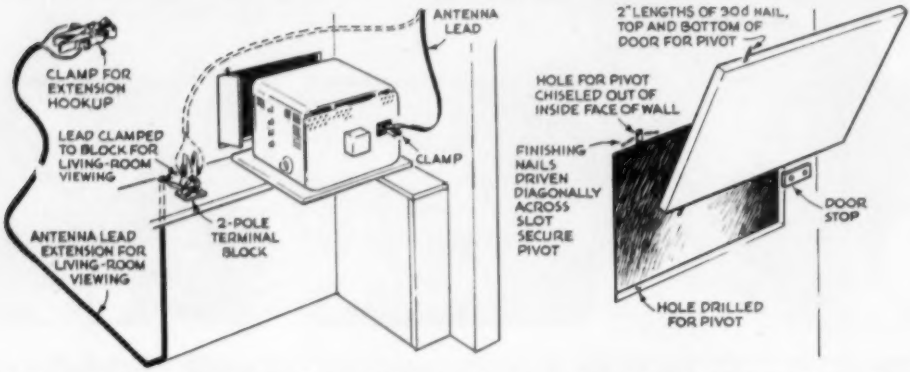
Standard equipment on Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet



Transfer its antenna clip to an extension terminal (right), and the built-in can be moved.



lation. The fussiest job was sawing an opening in the plywood closet wall. Not having a bayonet-type jigsaw, I used a portable electric one and worked up to the corners with a handsaw.

The pocket opening starts 28″ above the floor. Its height is a fraction of an inch less than that of the TV cabinet, to keep the set from creeping forward during tuning. Its width is 6″ less than that of the cabinet.

Dressing around the opening and the door (which is made from the cutout piece) consists of thin strips of matching wood veneer. Contact cement made bonding easy.

The set sits on a plywood shelf attached to the closet wall. I threaded the antenna lead down through the closet ceiling and attached a clothespin-type clamp to the ends of the wire. Normally this is clipped to the set's antenna terminal.

For the antenna-lead extension, I made a terminal block from two tempered-hardboard scraps and two aluminum bolts, spacing the bolts the same distance apart as the set's terminal screws. One end of an additional length of antenna lead is held by the bolts of this terminal, and is mounted close to the TV set in the closet. The other end has another of the clothespin-type clamps.

When we move the portable out of its hideaway for living-room viewing, we simply move the antenna lead's clamp off the set and onto the extension terminal. Then we move out the set, clamp the extension to its antenna terminals—and the show is on. END

"My Army Recruiter got me just the job training I wanted"

M/Sgt. James D. Kennemur
Army Recruiter
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"He helped me pick my course before enlistment"

"My Army Recruiter sure helped me to get the most out of service. He showed me how I could choose my job training course *before* I enlisted. Now I'm in a great course—surveying—learning to be an expert in my field. The instructors really know what they're doing, and we work with the best equipment there is. This should be a swell deal for *you*, too, because the Army has enough technical courses so that everybody can find one he really wants. And the best thing is that you're guaranteed the course *before* you enlist. I think you ought to look into this program. My Army Recruiter spent a lot of time helping me get just what I wanted, and I'm sure yours will, too."

John R. Fox

Pvt. John R. Fox
Parlico, California
Graduate, Parlico High School

YOUR ARMY RECRUITER WILL GIVE YOU THIS SAME OPPORTUNITY

The Army Recruiter in your town will show you how to get the same deal John got. You have over 100 courses to choose from—electronics, engineering, medicine, finance, radio and TV—practically everything. And the course you *pick* is the course you *get!* You get a written guarantee that you will be in that class. And not until after high school graduation do you actually enlist. If you're a senior, you can get in on this deal right *now!* You'll become an expert in your field. Just see your Army Recruiter and reserve the course of your choice—at no obligation!

Get choice, not chance, from your Army Recruiter

YOUR CAR DESERVES A

Sealed Power
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Piston rings wear out before cars do. When your car begins to smoke, and labors on a hill, and acts tired—give it the best piston rings on the market—Sealed Power KromeX. Sealed Power rings are used by every major engine builder in America! What's best for original equipment is best for replacement!

SAVE OIL! SAVE GAS! GAIN POWER!

You'll be amazed at the way your engine will purr happily along, with a new Sealed Power KromeX Ring Set! Your oil and gas bills will be lower—power will be higher. And driving will be so much more fun!

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Sealed Power
PISTON RINGS

BEST IN NEW CARS! • BEST IN OLD CARS!

How Radar Ships Protect Our Cities

[*Continued from page 139*]

"What's your normal speed?"

"About five knots," the Exec replied. "One boiler gives us enough power for full operation at any time. We've got two."

"How big a crew do you have?"

"About 170 men, including 44 radar and radio specialists. And we've got more space than we need. That makes life aboard more comfortable than it is on most ships."

"How do you get reprovisioned?"

"Heck," he said, "we sail with 400,000 gallons of fuel, 50 tons of fresh and frozen foods, 12 tons of dry food supplies. We make our own fresh water. Why, we could stay at sea a lot longer than we do."

NEXT MONTH:

24-Hour Watch on the Rhine: the story of our F-100 jets. They're ready to roll night or day from hidden hangars in West Germany.

WHEN I climbed back to the Scanner's deck, I noticed that she had but two guns.

"Is that all the protection you have?" I asked the Exec, who was escorting me to the gangplank.

He grinned. "That's about all."

"How's your gunners' marksmanship?"

"Pretty fair. They shoot at empty oil drums on the surface, balloons in the air."

"Is the Scanner equipped with sonar?"

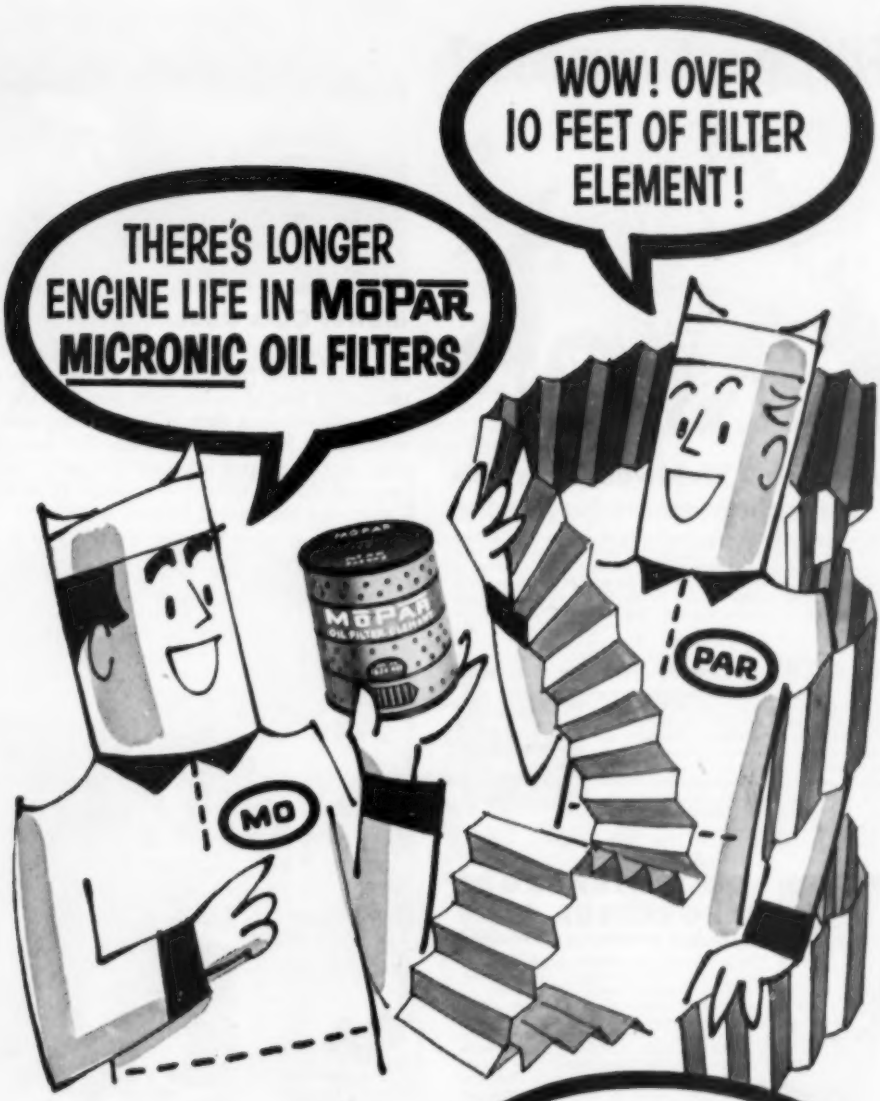
"Nope. There has been talk about it."

"Then an enemy sub could sneak up on you and put you out of commission without warning," I said.

"Correct," he answered, with a smile. "But if we get sunk, our sudden silence will be as much of a warning to the mainland as if we phoned details."

"That will be doing it the hard way," I commented as we neared the gangplank.

He shrugged. "We've got a vital job to do, and it has its risks—just like any other job of defense." END



Here's the oil filter that invites you to keep careful tab yourself. MoPar Micronic Oil Filters keep engines purring longer because they trap corrosive, abrasive particles down to .000039 of an inch . . . take out *one third* more dirt per square inch of filtering surface . . . offer a surface over 8 times that of conventional types. MoPar Filters fit most makes of cars. Make sure you get MoPar Parts — *official, authentic* Chrysler Corporation Parts, available from your local Plymouth, Dodge, De Soto, Chrysler or Imperial dealer.

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PARTS & ACCESSORIES

CHRYSLER CORPORATION — PARTS DIVISION

DETROIT 31, MICHIGAN

Fitting out your boat?

Let these 2 Weldwood Wizards work their magic for you!

Granted, you need no magic to conjure a vision of gliding downstream in a canoe . . . put-putting across a mountain lake . . . or sailing crosswind in a heeling sailboat. And frankly we hate to break the spell. But it's time to get her scrubbed, shipshape and shiny for the season ahead. That's where these two Wizards with Wood can help you do a lasting professional job.

FIRZITE® (The beauty treatment undercoat)

Many a "see-" worthy craft owes its smooth, grain-free, paint or stain job to Firzite. Because Firzite tames that wild, unsightly, wavy grain, keeps it from showing through the paint or stain . . . practically eliminates hair-line checking . . . helps achieve a smooth-as-glass, sure-to-last finish. Don't let wavy grain spoil your paint job. Start with Firzite. Two types: Clear Firzite and White Firzite in pints, quarts and 1 gallon cans.

WELDWOOD® WATERPROOF RESORCINOL GLUE

(Laughs at water and weather)

This is Weldwood's all-purpose glue for the boat owner. It is absolutely 100% waterproof. Withstands cold or boiling water . . . moist or dry heat . . . mold or fungus . . . mild acids or alkalies. Meets the most exacting government standards for marine work. So strong, it's widely used for everything from constructing hulls and decks . . . to installing cabinets and repairing windshields. No pre-heating or other materials are required. Simply mix and apply. In handy ¼ pints, pints, quarts, gallons.

At boat yards, paint, lumber or hardware dealers or mail coupon for free leaflets.

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Mower Cuts Under Water

THIS aquatic mower keeps a Czechoslovakian lake free of reeds. It has a vertical cutter that clips an eight-foot swathe to clear 15 acres a day. The cutting head, driven by joggle arms from the gas engine, is raised and lowered by cable. As it cuts off the underwater growth, it makes a path for the paddle-wheel scow.

Glass to Sheathe Skyscraper

THE old saw about people who live in glass houses doesn't faze the Corning Glass Works. They plan to house their offices in a tower of glass surrounded by its own landscaped plaza on New York's Fifth Avenue. A block-long corridor on the first of its 28 floors will be set aside as an exhibition area. The exhibit? The history and uses of glass, of course.

Test your skill — Let us send you the free puzzle that the Weldwood Wizard holds in his hand. It's lots of fun, and — it will help you choose the Weldwood adhesives best suited to each job. There are 4 Weldwood adhesives now, you know — read about 'em, then mail coupon for *your* free puzzle.

For wood-to-wood joints that never come loose—use

WELDWOOD *Plastic Resin* GLUE

Imagine—joints glued with this Wizard are stronger than the wood itself! And they grow even stronger with age! That's why it's America's most popular wood glue. Highly water-resistant, stain- and rot-proof. Easy-to-mix powder. 15c, 35c, 65c and larger sizes.

For weatherproof boat repairs—use

WELDWOOD WATERPROOF RESORCINOL GLUE

100% Waterproof! A "must" for any wood gluing exposed to climate, boiling or salt water, cold weather, mold, fungus, mild acids, alkalies, etc. Terrific for sporting goods, woodwork in damp basements, lawn furniture. ¼ pints, pints, quarts, gallons.

For in-a-hurry gluing of wood, paper, cloth, fabric—use

WELDWOOD PRESTO-SET® GLUE

Ready to use. Sets fast! Glues like magic! Presto-Set is the Weldwood-perfected white glue that bonds wood to wood, wood to cloth, cloth to paper, upholstery fabrics to wood, leather to leather, etc. Clean to work with – no sticky hands. 19c, 29c, 49c tubes; pint and quart jars.

For putting up plywood panels without nails—use

WELDWOOD® CONTACT CEMENT

Revolutionary! Speedier, easier, new way to install plywood panels. No nails, no holes to fill and finish. Bonds instantly, permanently on contact. No clamps and presses – ideal for applying plastic laminates like Micarta to table tops, kitchen counters, etc. 1001 other uses for home, hobby, garage. 29c, 40c, 70c and larger sizes.

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- ☐ Weldwood Presto-Set Glue
- ☐ Weldwood Contact Cement

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ADDRESS_____

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STOP WASTING MONEY on worn-out piston rings!

Oil-pumping is the first sign of worn-out piston rings. And worn-out piston rings mean power drop-off—costly wastage of gas and oil—expensive repairs later on.

The sooner you act, the less it will cost. See your motor specialist the minute oil-pumping warns you there's trouble ahead. When he recommends new piston rings, ask him for Hastings. They're engineered exclusively for replacement service . . . to provide the additional lubrication worn engines need . . . to stop oil-pumping, save gasoline and restore lost performance. Truly the best money you can spend on your car.

HASTINGS MANUFACTURING CO. • HASTINGS, MICH.

HASTINGS

PISTON RINGS

TOUGH on oil-pumping • GENTLE on cylinder walls

Buy these Hastings Products with confidence:
Piston Rings, Casite, Wear Reducer,
Oil Filters, Spark Plugs

How I Taught My Wife to Save Gas
[*Continued from page 98*]

celeration ranges. I knew that in Drive, even allowing for slippage in the transmission coupling, the engine would turn only 1,325 revolution at 30 miles an hour. I knew that with the transmission held in intermediate by the throttle, the r.p.m.'s shot up alarmingly. At open throttle it was almost 3,000 at 45 m.p.h.

At the gas pump, out of my wife's hearing, Luckett said, "Do you want to make this a little more interesting with a side bet?"

He wasn't helping matters any.

We took off. There was nothing to choose between the weather on the way down and now. It had been chilly, drizzly and windless then. It still was.

I fidgeted the first half-hour. We had to meander through a number of small towns. I sweated, easing in on the throttle, braking only when I absolutely had to.

I'd clocked the automatic gear changes in the transmission when my wife was driving. With the accelerator on the floor, her low-to-intermediate shift occurred at an indicated 25 miles an hour, intermediate-to-high at 49.

It was vital, if I were to make a showing, that I get into high gear fast. Experimenting now, I discovered that at feather-light throttle, I could nudge the car into intermediate at 12 miles an hour, and into high at 15.

As we emerged onto a good, two-lane highway, I decided to relax. If I couldn't prove my point by easy driving, it wasn't worth it.

At a stop light, I pushed the Neutral selector button while we waited.

"I doubt that that will do any good," commented Luckett from the rear seat. "Your throttle setting at idle is fixed. If anything, you're speeding up your engine by taking the load off of it."

My wife put in tartly, "No help from the audience, please!"

Now I had a four-lane road. The car was on perfect behavior. It had cats' feet on turns, and it almost anticipated my

[*Continued on page 240*]

Just pull the trigger...

spray paint!

The easier, better way to paint! Job's done in minutes. Finish is smooth, flawless. Speedy Sprayer is a real *professional tool*, favorite of craftsmen for over 35 years! At stores everywhere. 890 Outfit, including gun, hose, less motor, only $39.95

Speedy Sprayer *Wheel it to the job!*

FREE! "How to Spray" booklet and literature. Write!

WHEEL KIT $7.50 EXTRA

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FOR YOUR HOME, YARD and SHOP PROJECTS

nichols **NEVER-STAIN** & **RUSTPROOF**

ALUMINUM Nails

Guaranteed by Good Housekeeping

LOOK FOR THIS RED & WHITE DISPENSER

- Will never rust streak or stain
- Solid aluminum — no coating to chip
- Easy to drive — made of hard aluminum alloy
- Etched for great holding power
- Available in 10 popular types and sizes in reuseable plastic boxes

Also available in "Packaged-for-the-job" dustproof containers. At your hardware, building and lumber supply dealer.

nichols WIRE & ALUMINUM CO. DAVENPORT, IOWA *World's Largest Manufacturer of Aluminum Nails*

NEW Starrett No. 167 RADIUS GAGES

- Rustproof Stainless Steel
- No-Glare Satin Finish
- Handy Individual Gages
- Each With Five Gaging Surfaces
- Six Convenient Sets

MECHANICS, MACHINISTS, INSPECTORS . . . here's why you'll go big for these new Starrett No. 167 Radius Gages:

Stainless steel with no-glare satin finish — to make them rustproof and stainproof, easy on the eyes in any light. *Individual gages* — easier to use, less chance of errors. *Five gaging surfaces on each* — to handle any concave or convex radii. *Sizes from 1/64" to 1/2"* — in your choice of six convenient sets. Available with handy gage holder.

New No. 167 is only one of many new Starrett Tools you'll want for your kit. Your distributor or tool store will gladly demonstrate them or write for big, new illustrated catalog.

BIG NEW CATALOG — FREE

Describes and illustrates over 3000 Starrett Tools. Write for it. Address Dept. PS

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Since 1880 — World's Greatest Toolmakers

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Look what Dad built... a sound-conditioned game room!

Here's a game room where the kids (and you) can raise a rumpus without rousing the whole house and neighborhood. And you can build a room like this in your basement or attic for much less than you might think!

Gold Bond Acoustamatic Ceiling Tiles can be stapled – or nailed – easily and quickly to wood furring strips applied right over your old ceiling. Both Random and Regular patterns – shown above – have hundreds of perforations that soak up noise. You have a quieter room – and the soft, ivory finish makes the room bright and cheery.

The attractive walls are Gold Bond Insulation Planks and Tiles factory-finished in soft shades of ivory or a varied assortment of four harmonizing colors. They are made of wood fibers that swallow noise. Both take paint perfectly.

For detailed instructions on how you can build a basement room as attractive as this, send for free illustrated folder, "How to Remodel Your Basement." Write to National Gypsum Company, Dept. PS 37, Box 73, Buffalo 13, N. Y. Then see your local Gold Bond® Dealer – he has all the materials as well as helpful advice.

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How I Taught My Wife to Save Gas
[*Continued from page 238*]

movements on the controls. I watched ahead for zoned areas to avoid wasting gas on the brakes. I coasted toward red lights to save starting from full stops.

To keep from enriching the mixture on acceleration, I let the car creep up on the speed I had chosen. To make time, I kept the speedometer needle between 50 and 55 except in going uphill. Then, as the speed that had been built up on the downgrade was dissipated, I let it drift lower. It never got below 45.

"*You're* changing your speed," observed my wife, "just as I did."

"He's keeping constant throttle pressure," said Luckett, "a maximum manifold vacuum for the speed he wants. He thinks—"

"Thanks—" I said.

"—it will save gas," finished Luckett dourly to my wife.

"—for the first kind words from either of you," I said.

In a vote of confidence, Schnapps edged over and put his head in my lap.

I had seven miles of heavy noon traffic through Richmond, outskirts to outskirts. The gas gauge told me little. In the manner of Chrysler Corp. cars, the gauge in the Plymouth was swinging wildly. I could only try to average out the swings.

The speed limit was 45 miles an hour north of Richmond. I observed it. My wife hadn't.

I had five miles of Washington traffic.

"You can bypass Baltimore," suggested Luckett.

"Whoa!" said my wife. "Let's keep this honest. *I* drove through Baltimore."

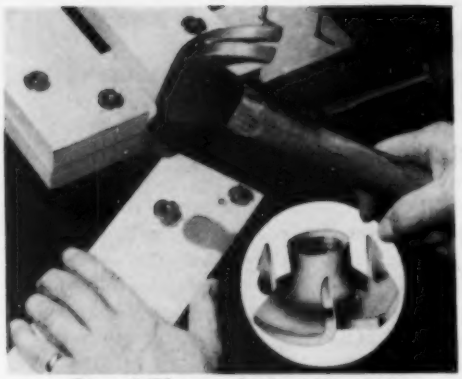
So I did, too—and the roof fell in on me. I hit the city's outskirts at the five p.m. rush hour. Nobody said anything. It took me 40 minutes to go eight miles.

We overnighted north of Baltimore. I topped off the tank, took the odometer reading and noted the time.

"Yes?" said Luckett at dinner, raising an eyebrow.

"I wouldn't give you two the satisfaction now," I said. "I'll not do any figuring

[*Continued on page 242*]



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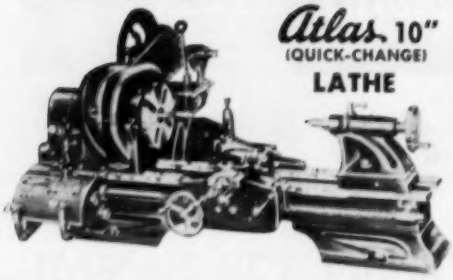

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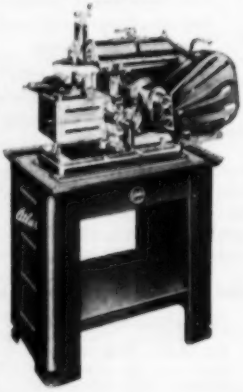

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How I Taught My Wife to Save Gas

[Continued from page 240]

until we get right into Philadelphia."

I was afraid to face the figures.

My wife said, "Maybe the man didn't fill the tank—pass the salt, please—all the way up."

"Or maybe—the mustard, please—" said Luckett, "there's a hole in it."

It was different the next day—worse. I had 2½ miles of crawling traffic in Wilmington, Del., and five of agonizing stop-and-go in Chester, Pa. We took a rest stop on the outskirts of Philadelphia.

"It's cold," said my wife. "Keep the engine running for the heater."

"That's a sneaky way to get a new hat," said Luckett.

Philadelphia was all congestion. This, I knew, would finish me. It was precisely 1:50 p.m. when I rolled into Independence Square. I refueled a block away.

Reluctantly, I got out my pencil. Presently I said, "Wow!"

"Bingo?" inquired Luckett politely.

The car had consumed 18.8 gallons of gas. I had driven, according to the map, 312 miles. My odometer actually registered only 306, and at least part of the disparity could be attributed to the bigger effective rolling radius of my wheels with their harder tires.

My average speed, despite traffic worse than that my wife had encountered, had been 32 miles an hour, or some five miles an hour short of hers.

And—the payoff I had hoped for—I had run just a smidgen under 16.6 miles to the gallon, or four miles better than my wife.

"So that's it," I said. The words came out a bit tarter than I intended.

My wife nodded. "You win," she said. "You're absolutely right." There was a pause. Then: "How much did you say we could save driving your way, dear?"

"Fifty dollars a year," I said.

"Fifty dollars." She got a far-away look in her eye. "You know, there's this new shop, and I was passing it the other day, and there was this adorable little black dress . . ."

I wonder just who did win. END

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Being a Good Father to a Gifted Child

[*Continued from page 105*]

while he learns to measure, plan and design.

Most gifted children are early readers. Don't let your youngster use his passion for reading as an escape mechanism. Kids like him need, as one educator phrased it, "more contact with the raw materials of life." Get him outdoors. Take him on hikes. Let him grow things. Encourage him to start a hobby of his own.

Provide new challenges. As his interests expand, give him more to think about. Discuss the news with him. Show an interest in what he has learned at school. Read aloud after dinner and discuss with him what you have read. Ask him to read aloud, too, when he feels like it.

It is especially important for you to find out his special interests and help him pursue them. Arrange to let him meet people in the community who are experts in these fields. Tell him how things were when you were his age. Let him in on some of the big events of your life. Tell him things about your job. Children love to share in the experiences of their parents, and it is very important in their emotional development.

Provide your youngster with books that are rich in details. Most gifted children love biographies, because they provide richer intellectual meat than the sketchy textbooks they have to read in school. Stock up on a few good biographies of outstanding men and women in the field of the child's chief interest. Get some first-rate reference books—an atlas, a respected encyclopedia, a biographical dictionary.

Watch your own behavior. Your exceptionally intelligent youngster worries about inconsistencies and contradictions that the average kid isn't even aware of. He quickly sees through bluff and pretense in the adults around him. Exposure during his tender years to older people who behave illogically or with deceit and hypocrisy will make him dubious and even contemptuous of authority.

[*Continued on page 246*]

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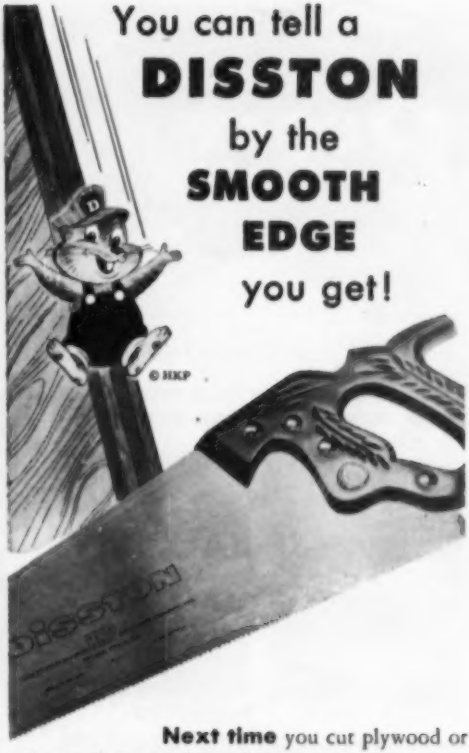

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Being a Good Father to a Gifted Child

[Continued from page 244]

If this attitude of cynicism persists when he grows up, it can be a big disadvantage to him. To get ahead, one has to play the game, no matter how stupid the rules may seem. To learn how to command, one must learn to obey.

Be firm. When you know you're right stick to your decision. Dr. W. Paul Allen, principal of the Fox Meadow School, Scarsdale, N.Y., reports that when gifted children in his school have been asked to write what they like best about their parents, often the essays have contained a statement like this: "We like our parents to say 'no' when we know they should say 'no.'" Bright youngsters know when your response to a plea ought to be negative, and when you give them the proper response, they are secretly comforted, Dr. Allen says, for they want their parents to be strong.

Parents tend to be overpermissive to gifted children because they don't want to hinder their self-expression.

When a gifted youngster becomes a smart aleck or an intellectual bully, it's easy to blame the American Mom, but it's just as much the American Dad's fault, for leaving everything to her.

"The gifted child needs to be made to think of others," Dr. Allen points out. "He should be taught that a person with special talents has more than the normal obligation to benefit others."

Don't overstress his superiority. If he excels, say, at swimming, point out to him that he should help kids who don't swim as well as he does. If he leads his class in mathematics, encourage him to help his less perceptive brother or sister or pal.

Don't be overprotective. "The great mistake parents make," says Prof. Harvey Zorbaugh, director of New York University's Counselling Center for Gifted Children, "is to expect their gifted child to achieve great things in life and then deny him the freedom to learn to meet life on his own. We've seen this pattern repeated over and over again in families of highly

[Continued on page 248]

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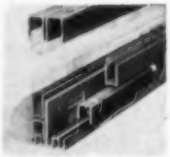

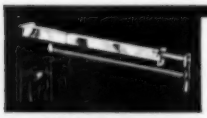

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Being a Good Father to a Gifted Child

[*Continued from page 246*]

gifted children. The conflict between overprotection and high expectation is one of the main reasons why gifted children so often fail to realize their early promise."

Other kids can go out and play. But the youngster with some special talent often is expected to practice at the piano, or go to dancing or art school, take drama lessons or visit museums.

Let your talented child be a child. "No matter how bright he is," says Dr. Paul Witty of Northwestern University, "he's still just a kid. He should be allowed to play, get dirty, eat rapaciously and have fun like any other child."

Don't be alarmed if your youngster doesn't finish every project he starts. Think how often you have failed to complete projects yourself, or tossed aside a book in mid-reading that you had begun with expectant zest.

Let your gifted child learn to budget his time and make his own decisions.

Make him write more. Because his vocabulary is better than that of most other kids of his age, and because his mind works faster, the gifted child sometimes hates writing. He'd rather talk. Thus he is often a poor speller and reluctant to write down his ideas. This will be a decided handicap later on if you don't halt that tendency. When a letter must be written to get him something he wants, persuade him to write it. If he likes to do scientific experiments, encourage him to write up what he has done.

"If fathers only knew how important they are in helping their children achieve self-confidence and self-reliance," Dr. Brumbaugh told me, "they'd keep the kids up half an hour later at night to see more of them." END

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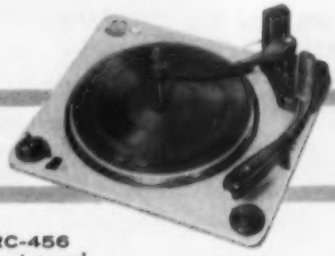

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[*Continued from page 119*]

variations in the record groove of a millionth of an inch.

Amplifiers? The ordinary phonograph has a couple of tubes and can handle a couple of watts of power. Hence the full blast of a symphony orchestra, which may work up 10 or even 20 watts of power, never gets through its puny coils, at least not without groaning. Some hi-fi amplifiers can produce up to 60 watts, or even more, with less than one percent of distortion.

No speaker—that most important of elements—is better than the parts that make it work. The magnet, for instance. Whereas the magnet in an ordinary low-fi set will weigh but a couple of ounces, the magnet in hi-fi speakers will weigh up to 15 *pounds*. The hi-fi speaker is more carefully constructed than the low-fi speaker, and the end result is better-sounding music. The speaker enclosure is even more important to the final result than the loudspeaker mechanism itself.

"High fidelity isn't any one invention," says C. J. LeBel, secretary of the Audio Engineering Society. "It's the result of joining a chain of well-designed, painstakingly made links."

HI-FI may be even higher-fi if the industry perfects some of its pet ideas. One is something called stereophonic sound—a process of recording in which the sound is picked up by microphones at two separate points, much as your two ears pick up slightly differing impressions of the same sound. When reproduced through two loudspeakers, its "presence" effect is fantastic—you can almost pinpoint the location of each part of the orchestra in your room. Some experts believe that 10 years from now stereophonic sound will be the only acceptable way to record music.

Hi-fi's potential market includes the 35 million plain, old-fashioned music-lovers who paid to attend concerts in 1955—twice as many people, incidentally, as those who paid to see major-league base-

[*Continued on page 252*]

SUPREME

Versamatic

REVERSIBLE SCREW DRIVER AND SPEED REDUCER

First time ever! It REVERSES!

Drive *and remove* screws with Supreme Versamatic. Versamatic reduces speed 7 to 1, increases power 7-fold. *Reverses* with one twist. Handles even the largest screws with ease. Also for nut running (adapter furnished); tapping; and all heavy duty drilling where speed reduction is needed. Fingertip control means safe, fast work. Complete set $14.95. (½" chuck extra). At hardware stores or direct from

SUPREME PRODUCTS Corp., 2222 S. Calumet, Chicago 16

DO EVERY FASTENING JOB 10 TIMES FASTER!

Amazing one-hand operation, 10 times faster than hammer & nails Can't jam

At your local hardware dealer or lumber yard

ARROW

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for ceiling tile, insulation, wire fence & every home job.

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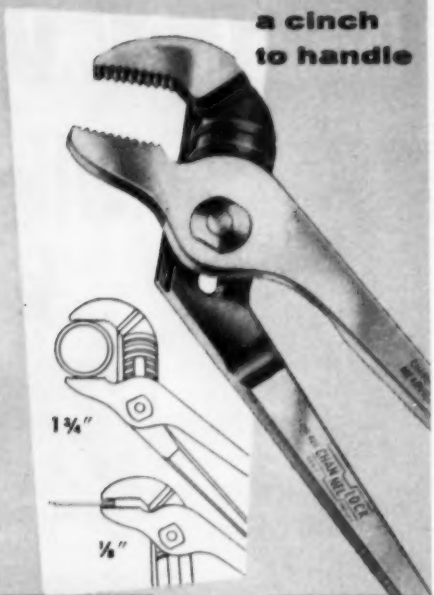

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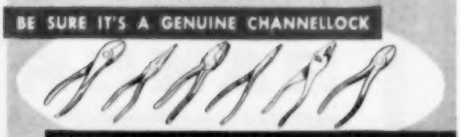
BE SURE IT'S A GENUINE CHANNELLOCK



CHAMPION DEARMENT TOOL CO. MEADVILLE, PA.

What's All This Fuss About Hi-Fi?

[*Continued from page 250*]

ball games. And since this new market neither speaks the lingo nor cares for the beauty of naked wire, the hi-fi industry is changing its style. The new components are sleek and handsome and demand little more technical skill than it takes to plug in a toaster. And the new advertisements don't talk about "cross-over networks" or "impedance." They just state that there is nothing in the world like high fidelity for enjoying the delights of music, be it Wagnerian or Armstrongian.

YOU no longer need to go in for models that may run into the thousands of dollars to get good-sounding high fidelity. As a matter of fact, you can buy a good high-fidelity set for around $200.

When you go shopping for your set, go to a hi-fi specialist and lean on his advice. Remember that some of the best component-makers are small firms whose names you may never have heard. Have your dealer show you the difference among various speakers and amplifiers by switching back and forth from one to another.

Beware of the "bargain." There is a fringe of fly-by-nighters seeking to cash in on the high-fidelity boom. If your specialist advises you against the cheapest unit on the shelf, he may be doing you a favor.

Once you've got your basic hi-fi rig, you can always add to it if you wish. And you probably will wish. For there is always the temptation, after you've charmed your guests with a Beethoven quartet that seemed to be played right in your room, of putting on another record, turning up the volume and startling them with that old summer thunderstorm. There's nothing quite like it. END

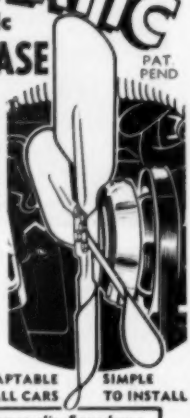
Next Month: All about power mowers—seven pages of facts, figures and straight talk on the 1957 machines.

Boost Your Power!

FAN-O-MATIC

Automatic FAN RELEASE

PAT. PEND



Automatically disengages fan at speeds over 40 mph!

At speeds over 35 MPH, standard automobile fans waste horsepower! The FAN-O-MATIC now makes your fan a free-wheeling unit, releasing wasted horsepower at speeds over 40 MPH.

- **Increases Available Horsepower . . . up to 15 HP**
- **Increases Gas Mileage . . . up to 2 mpg.**
- **Increases Acceleration . . . up to 10%**
- **Reduces Engine Noise**
- **Reduces Vibration**

ADAPTABLE TO ALL CARS — SIMPLE TO INSTALL

Tested and proved on Indianapolis Speedway under supervision of U. S. Auto Club.

2150

QUALITY SOLDER SEAL PRODUCTS

At your Garage, Ser. Sta. or Car Dealer!
If your dealer does not yet have it, ask him to write us for Jobber who can supply him.

RADIATOR SPECIALTY CO.
CHARLOTTE, NORTH CAROLINA

MAKE STRIPES with new PAINT PEN

Straight, curved, single or double

With any color paint, stripe furniture, bikes, autos, model planes, toys, linoleum, wallboard. Clean, crisp decorative lines. Can't clog or smear. Also use with glue, tempera, textile paint or undergiaze . . . on wood, glass plastic, ceramics, metals, fabrics and paper. Ask your dealer or order direct.

DEALERS	HOBBY	MFRS
Master paint striping tool in display carton. Write for discounts.	"Professional" results every time. Simple, easy to use. Order now.	Ask about heavy duty industrial striping tools.

DOUBLE STRIPE MODEL & COMBINATIONS. . . . **$3.25**

Single 1/16" stripe model $1.25

Other single stripe models $1.75 ea. 1/64", 1/32", 3/64", 5/64", 3/32" & 1/8"

Complete Kit (all 7 tips) $5.00

Extra tips 90c ea.

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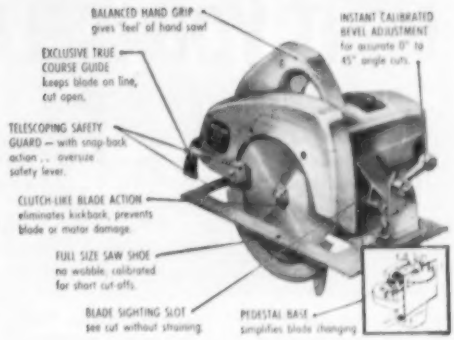
makes all cuts in 2" dressed lumber!



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6⅛" blade cuts 1⅞" @ 45°, 2⅛" @ 90°. Quickly inserted in table becomes tilt-arbor table saw—equals standard 8" table saw!

MAXAW 777 SAW TABLE

Steel construction, 24" x 20" oversize top. Cam Lock rip fence guide, calibrated miter gauge, convenient switch, outlet box. 46 lbs. without saw.

FOUR MAXAWS TO CHOOSE FROM — $49.95 to $84.95. For complete details write:

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IN JUST 3 TO 4 HOURS

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ANY time Sweden is fresh out of oil, gas and electricity, Mrs. Signe Olsson of Stockholm has her own invention to keep her tootsies warm—a candle heater. The candle burns inside an inverted funnel, and a hood over the top opening deflects hot air down towards the floor.

new Pressure Queen outperforms them all

Only portable 4-cyl. air compressor on the market! 4000 strokes a minute . . . free from pulsation without air tank . . . your best buy for spray painting.

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Cuts costs . . . one big job will pay for it. Built for heavy duty, continuous day-in-day-out operation. Use anywhere air can help . . . tires . . . grease guns . . . blow guns . . . etc. Trouble-free complete outfit • ready to use. Write 151 Railroad Avenue, Harrison, Ohio.

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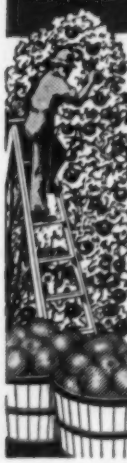
MIRACLE TOMATO Yields 2 BUSHELS To a Vine



Now—You can grow the world's most amazing Tomato right in your own garden and get from 2 to 3 bushels of delicious, ripe tomatoes from every vine.

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TOMATO grows 16 to 20 feet high. Huge, meaty, solid fruit, wonderful flavor. Some weigh as much as 2 pounds each. Unsurpassed for canning and slicing. Blight free—drought and disease-resistant. Grows in any garden. Outyields all other varieties.

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Perfectly balanced, cool running, fits the hand for pencil point precision in delicate work. 110 volt or 220 volt (if specified) 25 to 60 cycles AC or DC.

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With every type of cutting tool in metal case—$32.95
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Installs directly on door and jamb. No chiseling or cutting. A screwdriver is all you need to do a professional job. Heavy gauge steel . . . choice of finishes. Send for literature.

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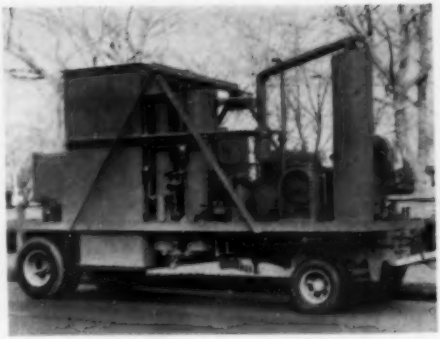

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THE weird trailer above is a mobile helium-purification plant for keeping the Navy's blimps aloft. A compressor driven by a gasoline engine draws impure gas from the bags. The helium is purified by passing it over drying beds and condensing it in a refrigeration system.

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R1 GENERATOR KIT Jack & Heints or GE. Rated 300 Amps. 24-32 Volts. With same items as above incl. 300 Amp Ammeter. Approx. GOVT. COST for kit $600. Complete kit only **$39.95.** Wt. 60 lbs.

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For boats, trucks, cars. By Pioneer Instrument Co., div. Bendix. Mark VIII. Graduated in increments of 1°; 360°. Major graduations every 5°. Magnetic. Can be lighted with 6, 12 or 24 volt standard bulb. Flush panel mounting. Approx. GOVT. COST $250. Perfect . . . **$10.95** ppd.

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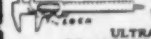
Can be used for pumping fuel, oil or wherever hydraulic pressure is required. Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. Max. capacity 6 GPM. 1½ H.P., 24 volt motor, 4000 RPM. Can be used on 12 to 36 volts. Approx. GOVT. COST $350. NEW — **$10.95.**



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MICROMETERS Chrome plated, precision engineered, carefully tooled to give long life. All new 0-1" cap. **$2.25** ea., 1-2" cap. **$3.50.**

LONG-FLUTE, HIGH SPEED DRILLS
15 assorted sizes. Up to ½". Like NEW. Approx. GOVT. COST $25. **Only $2.50.**

HIGH SPEED HAND TAPS
10 assorted, precision-ground thread. National Mfr. Like NEW. Up to ½". Approx. GOVT. COST $25. **Only $2.50.**

OFFSET DRIVE (180 DEG.) For use where tremendous power at low take-off RPM is desired. This unit drives through a chain of 6 steel gears rotating on 8 self-lubricating hi-speed roller bearings. Take-off shafts are 1½" diameter and ¾" diameter. Gear housing is forged, machined aluminum. Approximate GOVERNMENT COST $75.00. New, **$10.95.**

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ONLY **$2.45** each 3 for $7.00

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The handiest tool you can own for household jobs, your workshop, or hobby projects. Handles like a pencil. It saves time — makes all jobs easier — gives the finished product a professional look.

The Dremel Moto-Tool has an excellent record as a precision tool in industry. Fastest, most powerful tool of its kind —27,000 rpm. Buy a Moto-Tool—it will pay for itself in no time. See your dealer today.

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MOTO-TOOL KIT NO. 2 Includes Model No. 2 Moto-Tool, 23 accessories (high-speed-steel cutters, grinders, polishers, etc.) in a hardwood case $25.95
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SEE YOUR DEALER. If he cannot supply you, order direct from factory on a 5-day trial, money-back guarantee. Send full amount and we pay postage or send $2.00, and pay postman balance plus C.O.D. charges and fee.

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Makes Gardening FUN!

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Dept. P-18 NEWBURY, OHIO

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PERMANENT ALNICO

10 Assorted Magnets $1.00

Bulletin Board Magnets	10 for $1.00
Hot Pad Magnets	12 for $1.00. 50 for $3.50
Pencil Type Magnets	2 for 90c. 6 for $2.50
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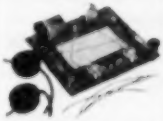

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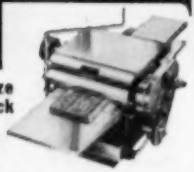

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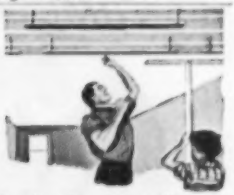

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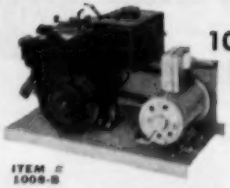

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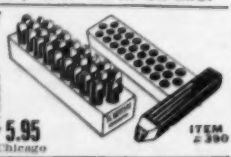

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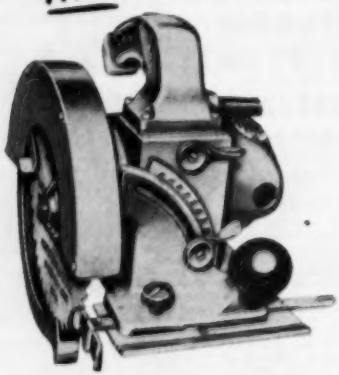

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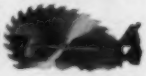

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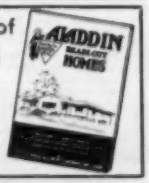

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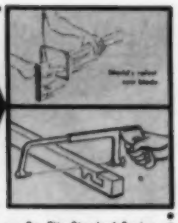

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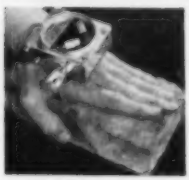

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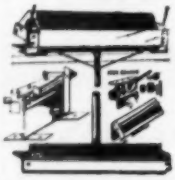

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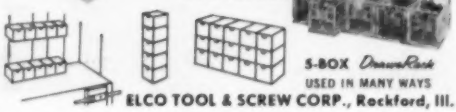

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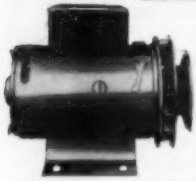

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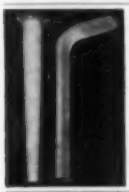

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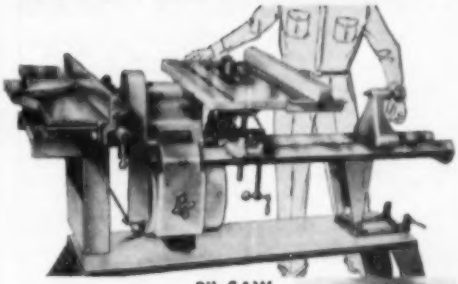

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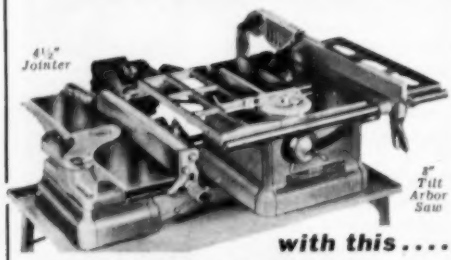

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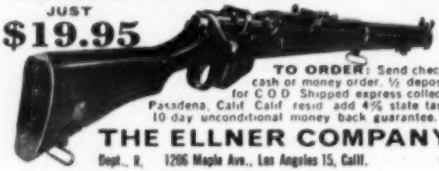

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17.95 VAL. **12.88**

Easily operated by any 1/4" (or larger) drill and can be adapted to any other similar drill. Saws straight lines or curves. Makes cornices, cabinets, toys, etc. Full 10" throat, cuts to the center of 20" board. Has a tilt table, ultra bearings, adjustable high impact, phenolic pulleys, 3/16" saw steel blade, die-cast aluminum housing.

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[*Continued from page 101*]

Then we should be able to get several billions of barrels a year from this source in the future?

Probably not. There are two limiting factors: a shortage of water for processing, and a problem of residue disposal. It's been estimated that for every million barrels of shale oil produced, even from oil-rich shale, you'd have to dispose of one million tons of oil-shale ash. Considering those factors, Eugene Ayres, of Gulf Oil Corp., estimates that about 1½ billion barrels a year is the best we can hope for.

What are tar sands?

Sand deposits in far northeastern Alberta, Canada, that are impregnated with a thick, tarlike oil. Two Canadian companies announced this past January that they will build a plant to exploit these deposits at a cost that will be competitive with crude oil. There's no estimate of the annual oil output, but it will probably be less than that of shale oil. Total bar sand deposits contain some 300 billion barrels of oil. The new project will tap deposits with an estimated potential of one billion barrels; the proposed plant will have an original capacity to produce seven million barrels of treated oil a year.

What about coal? How is it possible to get liquid fuel from that source?

It's not hard to imagine if you remember that coal and oil are basically the same thing. Both come from the ages-long compression of decayed vegetable and animal matter. Both are made up primarily of carbon and hydrogen. Perhaps the chief chemical difference is that coal contains less hydrogen. Conversion is accomplished by mixing the coal with hydrogen.

How do these processes work?

There are two main methods: direct hydrogenation of coal, and gasification followed by hydrogenation of the gas. In the first process, coal is crushed and mixed with oil to form a paste. (Once the process is started, a small portion of the oil produced keeps the operation recycling.) The paste is mixed with hydrogen and subjected to heat and pressure in the presence of a catalyst. Out come three streams: a gas stream consisting mainly of hydrocarbons plus some unreacted hydrogen; a heavy stream, some of which is eventually turned into high-purity graphite or coke, and a light stream of hydrocarbons and other compounds that can be treated to make liquid fuels and chemicals.

How about the gasification process?

Coal is reacted with oxygen and steam under pressure, producing a gas—mostly carbon monoxide and hydrogen—which is fed to a reactor where, in the presence of a catalyst, hydrocarbons are formed. These can be treated to make liquid fuels and chemicals.

How about the cost?

Generally, they're not competitive today. Gasoline from coal costs 1½ to two times as much as from crude oil. But in World War II, Germany made about one-third of its liquid fuel from coal. And today, in South Africa, a commercial oil-from-coal plant is using the gasification process. It's competitive there because of the high cost of imported liquid fuels.

Some day, when crude-oil costs climb, and the supply falls far enough behind demand, oil from coal will undoubtedly be a major source of liquid fuel.

Then with crude oil and shale oil and oil from coal, won't we have enough to supply us indefinitely?

Not indefinitely. We're bound to use them all up eventually. Some say in 100 years, some say 200 or more. But long before that happens, we'll have found other ways to make electricity, run industry, heat our homes and drive boats, trains, planes and cars. Atomic energy is a good possibility for some of those jobs, as are energy from the sun, wind, water, and heat in the air. END

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Rugged 8¼" saw for the builder who needs extra speed and power on all cutting jobs. Features Kickproof Clutch. Regularly $99.50—with electric saw trade-in ..... $84.50.

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Heavy duty 7¼" saw with blade on left. Weighs only 13 lbs. Professional features throughout include exclusive Kickproof Clutch. Regularly $95.00—with electric saw trade-in ... $80.00

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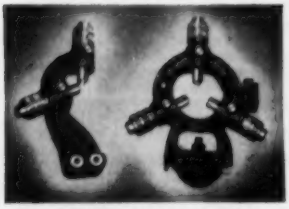

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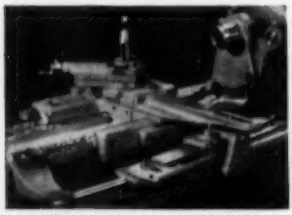

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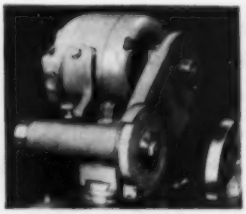
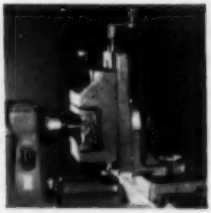


EXTERNAL GRINDER



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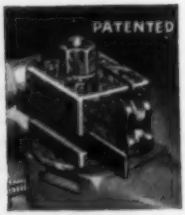

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For the first time ever: ONE TESTER PROVIDES ALL THE SERVICES LISTED BELOW!

IT'S A CONDENSER BRIDGE with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A RESISTANCE BRIDGE with a range of 100 ohms to 5 megohms.

IT'S A SIGNAL TRACER which will enable you to trace the signal from antenna to speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A TV ANTENNA TESTER The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

SPECIFICATIONS

SIGNAL TRACER SECTION

A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

CAPACITY BRIDGE SECTION

4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the **power factor** of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Expect, of course, when the R C combination is part of an R C bank.)

TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy. Only **26.95**

Superior's New Streamlined Model TD-55

TUBE TESTER

QUICKLY AND EFFICIENTLY TESTS RADIO AND TV TUBES INCLUDING: SEVEN PIN MINIATURES; EIGHT PIN SUBMINARS, OCTALS AND LOCTALS; NINE PIN NOVALS

YOU CAN'T INSERT A TUBE IN THE WRONG SOCKET. It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"FREEPOINT" ELEMENT SWITCHING SYSTEM. The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or, even the "top-cap."

CHECKS FOR SHORTS AND LEAKAGES BETWEEN ALL ELEMENTS. The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION. One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TD-55 comes complete with operating instructions and charts. Use it on the bench — use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions. **26.95**

FOR TESTING AND REPAIRING ALL ELECTRICAL APPLIANCES, AUTOMOTIVE EQUIPMENT—TV TUBES

Superior's New Model 70 UTILITY TESTER®

As an electrical trouble shooter the Model 70:

Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc. • Will measure current consumption **while the appliance under test is in operation** • Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc. • Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms) • Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc. • Will test **all** TV tubes for open filaments, inter-element shorts, burned out tubes, etc. (Will not test TV tubes for **quality**. An emission type tester such as the model TD-55 described above is required to test tubes for **quality**.)

As an Automotive Tester the Model 70 will test:

• Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

Handsome round-cornered molded bakelite case, 3⅛"x5¾"x2½". Complete with all test leads. Also included is a 64 page book giving detailed instructions, for testing all electrical appliances, automotive equipment, TV tubes, etc. **Only** **15.85**

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USING THE NEW *"FULL-VIEW"* METER.
71% MORE SCALE AREA!!

Yes, although our new FULL-VIEW D'Arsonval type meter occupies exactly the same space used by the older standard 2½" Meters, it provides 71% more scale area. As a result all calibrations are printed in large easy-to-read type and for the first time it is now possible to obtain measurements instead of approximations on a popular priced pocket-sized V.O.M.

FEATURES

Compact — measures 3⅛" x 5⅞" x 2¼" Uses "Full View" 2% accurate 850 Microampere D'Arsonval type meter. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

Model 770A comes complete with self-contained batteries, test leads and operating instructions.

SPECIFICATIONS

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